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MUSKETRY REGULATIONS.

PART II.

RIFLE RANGES AND MUSKETRY APPLIANCES.

1910.

(*Reprinted, with amendments, to* 31*st October* 1914.)

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War Office,

3rd November 1914.

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MUSKETRY REGULATIONS.
PART II.

CHAPTER I.

GENERAL INSTRUCTIONS FOR THE USE AND SELECTION OF SITES FOR CLASSIFICATION, AND FIELD PRACTICE RANGES.

1. All War Department ranges will be in charge of the Royal Engineers : the provision and maintenance of all appliances, including all targets the use of which is contemplated by the Regulations, will be an Engineer service.

2. *Range Wardens.*—The following duties in connection with ranges will be carried out, under the orders of the Commanding Royal Engineer, by civilian subordinates called Range Wardens :—

Care of ranges and apparatus.
Care, custody and issue of all stores.
Manufacture and repair of penetrable targets, and repair of apparatus. (*See* Chapter VI.)
All minor repairs to butts and firing points, and collection of metal from butts. (*See* para. 611 Part I, Musketry Regulations.)

3. The number of Range Wardens to be employed on each range will be determined by the General Officer in charge of

Administration, subject to War Office approval. Their general conditions of service will be those laid down for civilian subordinates. They will be selected by the Commanding Royal Engineer, preference being given to ex-soldiers. The Senior Range Wardens on large groups of ranges will be specially selected in view of the responsible nature of the duties.

4. When ranges are in use the Range Wardens will take the direct instructions of the officer detailed to supervise and administer the range, or in his absence of officers in charge of parties using the range, as to hours of practice, stores, targets and apparatus required.

5. When considered necessary, troops using the range will be detailed to assist the Range Wardens in minor repairs to butts and firing points, such work will be performed without claim to pay. With these exceptions, no soldier may be employed on a rifle range, either permanently or temporarily, to assist Range Wardens in their duties.

6. Units using ranges are responsible for the cleanliness of all parts of the ranges.

7. For musketry camps special Staffs will *not usually* be required. The senior officer in camp will act as Commandant, and will make all arrangements as to arrivals, departures, allotment of camping grounds, ranges, &c. In very exceptional circumstances an officer (preferably a subaltern), as camp adjutant and quartermaster, and a clerk (lance corporal or private) may be detailed to assist the camp commander.

8. The following are short definitions of the various rifle ranges in use :—

(*a*) *Classification Range.*—The general type of range constructed for the execution of classification practices. (*See* Chapter II.)

(*b*) 30-*Yards Range.*—A range for use with the service cartridge at 30 yards, and provided with such protection, either natural or artificial, as to dispense with the need of a danger area. (*See* Chapter III.)

(*c*) *Field Practice Range.*—A range specially constructed and provided with suitable apparatus for the execution of field practices under conditions approaching those of service. (*See* Chapter IV.)

(*d*) *Miniature Cartridge Range.*—A range for use with ·220 ammunition only. (*See* Chapter V.)

9. When it is proposed to construct a new classification or field practice range for the use of the regular forces, or to reconstruct an existing one, the matter will be dealt with in the first instance by the General Staff at Command Headquarters, who will advise the General Officer Commanding-in-Chief on all questions relating to the necessity for the proposals, the locality, &c., &c. The question of policy should then be referred to the War Office. When the general preliminaries are settled the subject will be dealt with by the General Officer in charge of Administration. If it is decided to proceed with the work, the Commanding Royal Engineer of the district concerned will request the officer commanding troops at his station to assemble a Board of two or more officers to report upon the proposal. The Board should consist of an officer not under the rank of major, specially selected on account of his knowledge and experience of musketry duties, an officer of the General Staff, a Royal Engineer Officer, and, where quartering of the troops has to be considered, an Army Service Corps officer.

10. The Board will make a careful inspection of the site, and will prepare a report on A.F. K 1309 of a nature to give complete information on all points. This is to be accompanied by an Ordnance map, 6-inch scale, contoured at 50-feet vertical intervals, including all ground affected by the proposals, on which the range, position of firing points and targets, and limits of danger area which it is proposed to acquire, will be clearly marked.

The report should embody information and recommendations on such of the following points as may be required, having regard to the class of range, and on all others which local conditions demand :—

Report on proposed range at.....

i. (*a*) Name and situation of range.
(*b*) Units which will use the range, and their addresses.
(*c*) Is the range to be used for classification practices only, for field practices only, or for both?

ii. *Details of the range.*
(*a*) Length of range (yards).
(*b*) Number and type of targets to be provided, and distance from centre to centre.
(*c*) Nature and dimensions of stop-butt.
(*d*) Nature and description of markers' gallery.
(*e*) Formation of firing points.
(*f*) Telephone or other system of communication, with diagram, list of stores, etc.
(*g*) Workshops and Target stores.
(*h*) Troop shelters.
(*i*) Latrines.
(*j*) Water supply and drainage.

iii. *As to ground, &c.*
(*a*) The length and breadth of the danger area, and nature of the soil. If below regulation size the reason should be stated.
(*b*) Character of ground in rear of targets, height, slope, &c.
(*c*) Character of ground in front of targets, if rising or falling towards targets. Is it free from obstructions such as hedges, ditches, &c.?
(*d*) Whether the area is purchased or leased, or if firing rights only are to be obtained. (In the latter case the proposal is not to be submitted till the written consent of the landowners is obtained.)
(*e*) What arrangements are proposed to prevent persons entering the danger area while firing is in progress?
(*f*) Whether the danger area is free from buildings, railways, roads, paths, &c.

iv. *Land questions, communication, &c.*

(*a*) Will any new roads be required to give access to the range?

(*b*) Is any diversion of right of way, or stoppage of traffic required?

(*c*) Do any common rights as to grazing, &c., exist?

(*d*) If land has to be purchased or leased, details should be given as to its probable cost per acre, and as to the names of the owners and the nature of their tenure.

NOTE.—Enquiries under this head must be made so as not to commit the War Office in any way.

11. This report will be passed to the Commanding Royal Engineer of the district, who will further consider the questions of construction of butts, firing points, &c., the purchase or hire of land and questions of right of way, the provision of new or alteration of existing electrical communications, and prepare rough sketches to illustrate the report, and such approximate estimate of cost as may be found possible from the data available.

12. The Commanding Royal Engineer, after obtaining the general concurrence of the officer commanding troops at the station in the proposals, will forward the report, plans, &c., through the Chief Engineer, to the General Officer in charge of Administration, for submission to the War Office, in order that sanction may be given to carry out the work.

Technical difficulties as regards the design may be referred direct to the Commandant, School of Musketry.

13. When a W.D. classification, field practice, or 30-yards range has been newly constructed or re-constructed, it will be inspected by a Board consisting of a specially selected officer as President, an officer of the General Staff and an officer of Royal Engineers. Whenever possible, an expert officer deputed by the Commandant, School of Musketry, will attend. The Board will render a report as to its safety and completeness through the Commanding Royal Engineer of the district to the General Officer in charge of Administration.

The procedure in the case of Territorial Force ranges will be similar; the board (constituted as far as possible as above) being assembled by the Territorial Divisional General concerned.

14. The date on which a range has been taken into use or closed will be reported to the War Office. In the latter case the reasons for closing the range should be stated.

15. When it is proposed to construct a new classification field practice or 30 yards range for the use of the Territorial Force, or to reconstruct or alter an existing range in such a manner as to affect the safety of it, the matter will be dealt with in the first instance by the County Association concerned, who will consult the General Officer Commanding the Territorial Division as to the necessity for the service. If units controlled by more than one County Association are affected, a joint committee should be formed, and the percentage of the expense which each committee is to bear decided on.

The General Officer Commanding the Territorial Division will then assemble a Board, constituted as far as possible as in paragraph 9, whose duties will be similar to those laid down in paragraph 10. The Board will, in addition, prepare an approximate estimate of the cost of the proposal. Their report (submitted on A.F K 1309) and plans may, if technical difficulties render such a course desirable, be forwarded to the School of Musketry, Hythe, for consideration.

The proceedings of the Board, with the A.F. K 1309 and accompanying plans, will then be submitted, through the County Association or Associations concerned (who will specify the source from which the necessary funds are to be obtained), to the General Officer in charge of Administration at Command Headquarters for submission to the War Office. Any subsequent correspondence that may take place between the War Office and the County Association on any points which may affect the training value of the range should be communicated to the General Officer Commanding the Territorial Division, Mounted Brigade Commander, or Commander of Coast Defences concerned.

This officer's opinion will be stated in the correspondence and will be forwarded to the War Office for consideration.

Boards should not, however, be assembled to report on repairs or minor alterations not affecting the safety of ranges, nor is it

the intention that Boards should be assembled to inspect and reconsider existing ranges which have hitherto been passed as safe for use with the service rifle, and with regard to which no complaints have been made.

NOTE.—For instructions regarding the procedure in the case of proposals for New Miniature Cartridge Ranges, see Chapter V.

DANGER AREAS OF CLASSIFICATION RANGES.

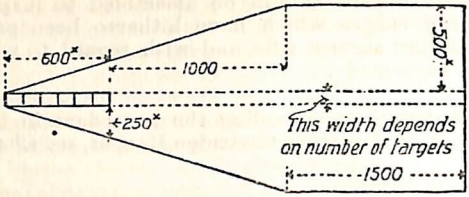


Fig. 1.

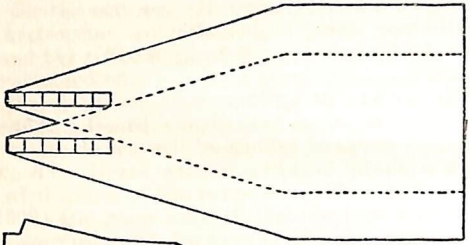


Fig. 2

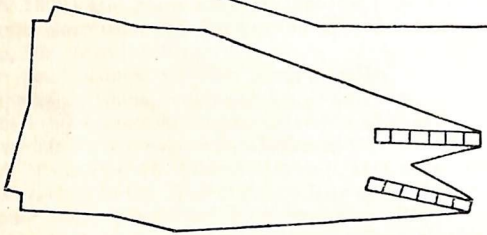


Fig. 3.

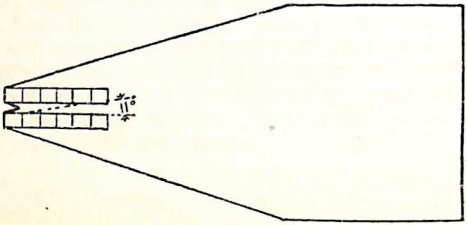


Fig. 4.

CHAPTER II.

SELECTION OF SITES FOR AND CONSTRUCTION OF CLASSIFICATION RANGES.

16. *General Consideration.* — The chief requirement of a classification range is that classification practices can be carried out with safety at the distances laid down in the Musketry Regulations. It is desirable, however, that there should be facilities for firing at 800 yards or even longer ranges. As a general rule a site on level dry ground is the best. Even a slight rise in the direction of the line of sight is a disadvantage, as will be seen by reference to Figures 6, 7, and 8, Plate 2. In Figures 7 and 8 the slopes are about 1 in 75 and 1 in 40 respectively: ricochets rising from these slopes at an angle similar to that shown in Figure 6 would probably range 100 and 200 yards further. Rocky ground should be avoided on account of the increased danger of divergent ricochets, and the probable extra cost in the construction of the gallery and stop butt. A damp or marshy site is also unsuitable, for the following reasons :—

(i) The danger of floods after heavy rain.
(ii) Constructional difficulties, such as the stop butt sinking, targets getting out of plumb, &c.

17. *Danger Area.*—The danger area will vary according to local conditions; for instance, when a range is sited so that the line of sight runs along the side of a hill, or when a spur of a hill comes within the danger area from one side only, consideration must be given to the fact that the slope will tend to throw ricochets more to the opposite side of the danger area. *See* also paras. 18 to 20. In any case, for a new 600 yards range of eight targets or more on level ground, firing rights must be obtained over an area having a depth of not less than 2,500 yards behind the targets, with a width of 250 yards beyond the flank lines of fire at the targets; this width to be increased to 500 yards at from 1,000 to 2,500 yards behind the targets (*see* Plate 1).

For ranges with less than eight targets on level ground, the width of the danger area beyond the flank lines of fire may be reduced as shewn below.

No. of targets.	Width at targets.	Width 1,000 yards behind targets.
1–2	100 yards	250 yards.
3	125 ,,	300 ,,
4	150 ,,	350 ,,
5–6	175 ,,	400 ,,
7	200 ,,	450 ,,

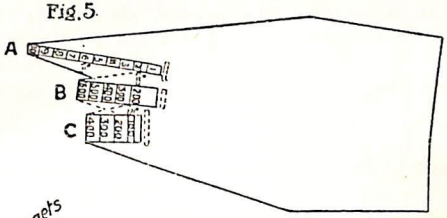
18. *Adjoining Ranges.*—Whenever it is desired to construct two or more ranges on adjoining sites, a smaller danger area will be secured by an arrangement whereby their longer axes converge slightly, *vide* Plate 1. The danger area required by an arrangement as in Figure 3 is less than that required when the ranges are sited as in Figure 2. Similarly, in the case of existing ranges, by the adoption of this method it will be frequently possible to increase the number of targets within the existing danger area, or with but a small addition to it. It should, however, be noted that the axes of the ranges cross one another at about 1,200 yards behind the targets. If the ranges were made to converge in such a way that the axes crossed at or near the targets, a considerably larger danger area would be required.

Figure 5, plate 2, illustrates the application of this principle to a large scheme, where, in order to enable firing to proceed simultaneously at different ranges, the target galleries are placed in echelon. But ranges in deep echelon are dangerous, owing to the chances of a ricochet from the rearmost range striking a firer on the advanced range.

The lateral distance required between gallery ranges provided with penetrable targets is regulated by the necessity of providing for the safety of the firers, when firing is proceeding simultaneously at a long distance on one range, and a short distance on the other. As it will seldom be required to use adjoining ranges at 100 yards and 600 yards simultaneously, it will usually suffice to site the ranges so that firing can take place at 500

Danger Areas Adjoining Ranges.

Fig.5.



DISADVANTAGE OF UPHILL LINE OF SIGHT

Fig.6

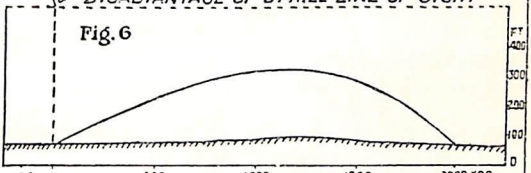


Fig.7

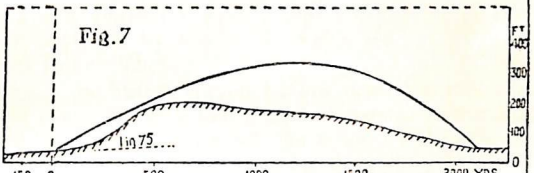
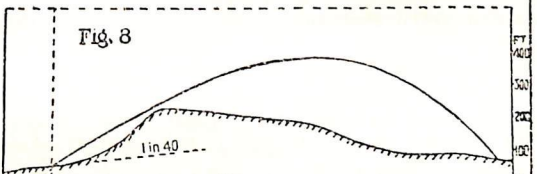
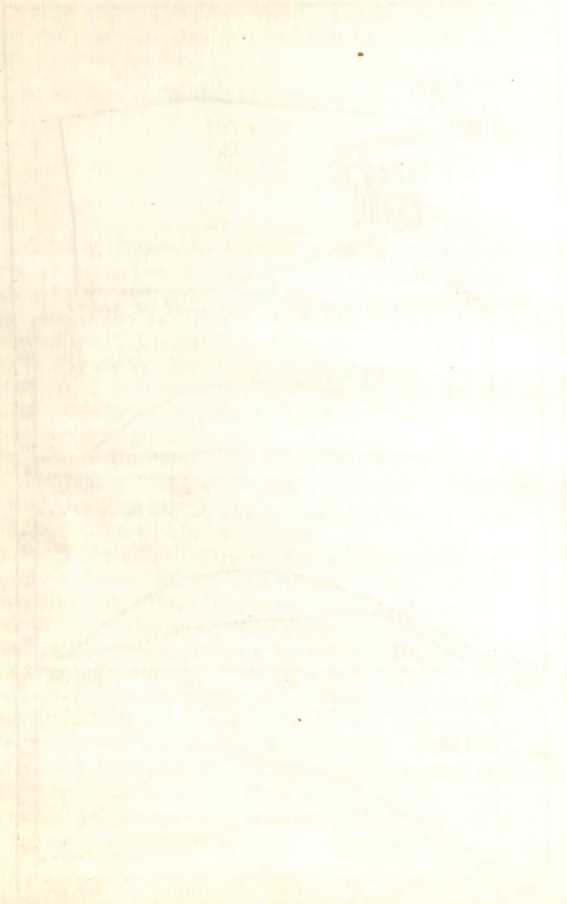


Fig. 8





yards on one range while the other is in use at 200 yards. In such circumstances a sufficient margin will be obtained by fixing the 200-yards firing point of one range in such a position that a line drawn to it from the 500-yards firing point of the next range describes an angle of not less than 11 degrees with the line of fire of the latter (*see* Plate 1, Figure 4).

19. *The value of a hill background* is usually overestimated because :—

(i) it is regarded solely as a natural stop butt for bullets fired accidentally with undue elevation, and not in relation to the trajectory of ricochets.

(ii) Its height is measured from the level of the targets, whereas *its effective height* is the perpendicular from its summit to the line of sight produced.

Regarding (i), the mean angle of rise of a bullet on first ricochet is normally double that of descent and often amounts to 1 in 4 or more

First ricochets at 30 yards from the firer, off sand, dry turf, or clay, have been known to travel 2,000 yards, and the mean range of such ricochets has been found to be over 1,500 yards. It may be accepted as a general principle that at short range the nature of the surface struck by the bullet exercises but little effect on the range of the ricochet.

The further the bullet travels before it strikes the ground the less does its range on ricochet tend to become. Nevertheless, it is on record that bullets striking the ground 400 yards from the muzzle of the rifle have travelled 1,700 yards. At 2,000 yards bullets ricochet less frequently than at shorter distances.

Impact on a hard uneven surface increases divergence, but does not necessarily reduce range.

Bullets must lose a considerable portion of their velocity by striking the ground, hence the trajectories of long ranging ricochets will be more curved than those of direct shots which travel a similar distance.

Ricochets from ground rising slightly usually range further than from level ground. If, in addition, the line of sight is uphill, they will travel still greater distances.

Few data exist regarding the flight of bullets after second or subsequent ricochet. Shots which have struck the ground, for the second time, at distances not exceeding 1,500 yards, have, however, been known to travel 400 yards before their third impact.

In view of the above, a hill background having an elevation of 200 feet will only be effective if:—

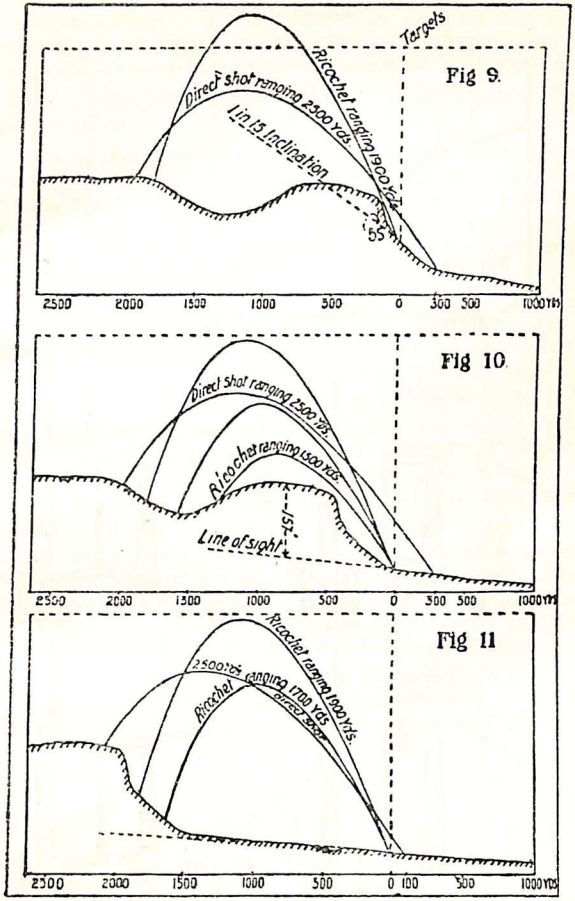
(*a*) Its face is nearly vertical, and the targets are close to its foot, or,

(*b*) The targets are about 1,600 yards from the foot of the slope.

It may generally be assumed that the full danger area will still be necessary for a range with a hill background, unless the hill is 400 feet above the line of sight.

Figures 9, 10, and 11, Plate 3, show a typical form of hill background and the relative merits of different positions for siting the targets. In Figure 9, where the targets are sited half way up the slope, the hill background is a positive disadvantage owing to the fact that ricochets off the ground just in front of the targets may be expected to range over 2,000 yards; and also to the fact that owing to the inclination of the line of sight, a badly aimed high shot which does not go very far above the targets has sufficient elevation to clear the hill and travel some 2,500 yards.

In Figure 10, where the targets are sited at the foot of the slope and the line of sight is nearly level, there is much less risk of a direct shot being fired at such an angle of elevation as to travel 2,500 yards, as the rifle would have to be deflected upwards through a considerably greater angle than would be the case on a range sited as shown in Figure 9. Moreover, owing to the comparatively level line of sight and therefore the greater angle through which a bullet must be deflected after striking the ground in order to travel far, long-ranging ricochets are less to be feared when the targets are sighted as shown in Figure 10.


Targets
Ricochet ranging 1900 yds
Direct shot ranging 2500 yds
Line of Inclination
Fig 9.
2500 2000 1500 1000 500 0 300 500 1000 Yds
Fig 10
Direct shot ranging 2500 yds
Ricochet ranging 1500 yds
Line of sight
2500 2000 1500 1000 500 0 300 500 1000 Yds
Fig 11
Ricochet ranging 1000 yds
2500 yds ranging 1700 yds
Ricochet
Direct shot
2500 2000 1500 1000 500 0 100 500 1000 Yds

Hollow Site.

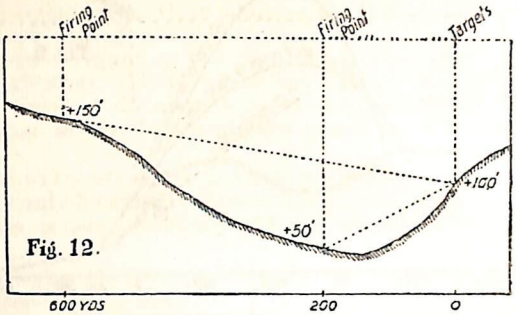


Fig. 12.

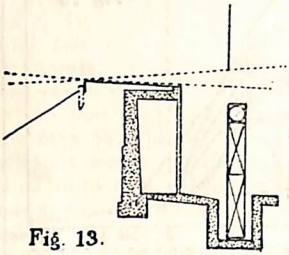


Fig. 13.

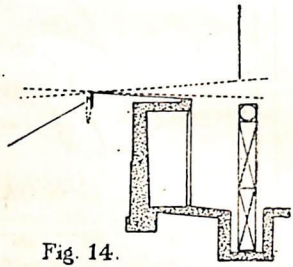


Fig. 14.

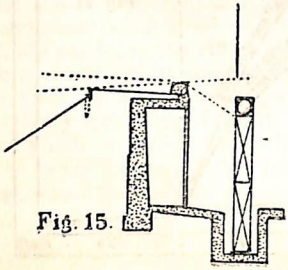


Fig. 15.

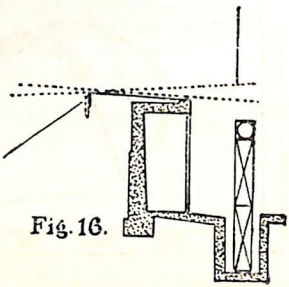


Fig. 16.

The hill, however, is not of any value even in this position. Figure 11 shows the best position for the targets. On such a site, the hill adds considerably to the value of the danger area.

20. *Hollow Site.*—A hollow site is objectionable for the following reasons :—

The line of fire from the shorter distances must almost invariably be up hill, and the disadvantages of a range of this section have been defined in paragraphs 16 and 19. A target frame, moreover, suitably sited for firing from the shorter distances, is liable to be struck by a shot from the longer distances.

For instance Plate 4, Figure 12, shows the section of a range, and the lines of sight from the 200- and 600-yards firing points. Figure 13 shows the same gallery and lines of sight to a larger scale ; it will be apparent that the bottom portion of the target is not visible from the 200-yards firing point.

Figure 14 shows an unsound method of overcoming this defect, by raising the target frames. This allows the target to be clearly seen, but it brings the iron frame of the target apparatus dangerously near the line of fire from the 600-yards firing point.

Figure 15 shows the result of building up a turf bank so as to protect the head of the iron frame ; the turf bank is only an added source of danger, as it is not bullet proof, and bullets are deflected downwards by it, and thus render the markers liable to be struck by splinters off the target frames.

Figure 16 shows a way of neutralising these defects, by lowering the frames and lengthening the legs of the target, but in this case a specially deep frame would be required for the targets. Lowering the frames and providing two sets of wooden targets, one set with long legs for use from the shorter ranges, the other set with shorter legs for use from the longer ranges, is a fair solution, and permits of the ordinary iron frame being kept in use.

In the case of existing ranges of the type under consideration, the best solution, both as regards the safety of the markers and the depth of the danger area required, appears to be to employ the existing gallery for the longer ranges only, and to build a new gallery near the bottom of the hill for use at short ranges. The new gallery might be so sited that practices can be fired simultaneously at short and long range.

21. For penetrable targets, whatever apparatus or pattern of frame for holding the targets is to be adopted, the requirements of the gallery (or marker's shelter) are practically the same, the conditions to be fulfilled being :—

(*a*) Height not less than 6 feet 6 inches.

(*b*) Ample protection to secure safety to markers.

(*c*) To facilitate marking, the markers should be able to see the strike of the bullets on the stop butt.

(*d*) The roof of the gallery should slope slightly towards the target, so as to avoid, as far as possible, ricochets from the roof on to the target. A layer of earth (free from stones), sand, or tan, lessens the chance of ricochets.

The crest of the gallery roof should be defined with a plank on edge as shown in Plate 5, Figure 17, and care should be taken to keep the gallery crest up to that limit, and to avoid the formation of scoops under the targets as in Figure 18, these scoops being a great source of danger owing to the widely divergent ricochets caused by shots striking the sides of the scoop.

(*e*) The bottom of the target when raised should be clearly seen from all firing points.

22. Plates 7, 8, and 9 show types of galleries. Plates 7 and 8 are suitable for normal ranges, while Plate 9 is suitable for very long ranges, or for ranges built in deep echelon, on which the gallery is liable to be struck by ricochets from other ranges. In this case a target store should be provided in the gallery with a bullet proof back wall and a ricochet-proof roof, the back wall being further protected by an earth bank 3 feet thick at the

Gallery or Marker's Shelter.

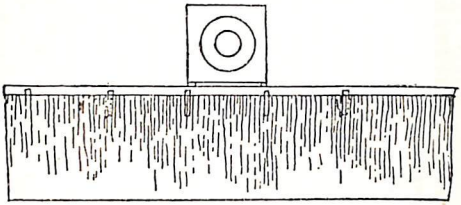


Fig. 17. GOOD.

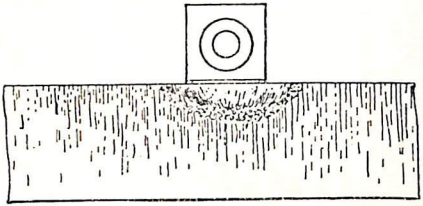


Fig. 18. BAD.

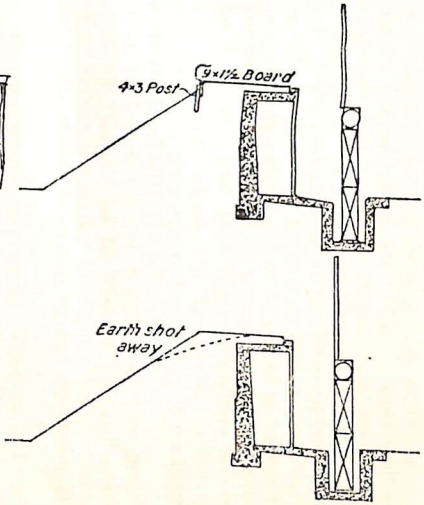


PLATE 5.

top and the crest made up in the same way as the crest of the gallery shewn in Plates 7, 8, and 9. Three inches of concrete is ample protection for a horizontal roof of this description.

23. The actual level of the floor of the gallery with reference to the surface of the ground will be for local consideration. It may be necessary to keep the gallery as low as possible so as to reduce the height of the stop butt, or to raise the former in order to provide for efficient drainage of the gallery and target trench.

It must be borne in mind that fewer ricochets are likely to occur from a range on which the targets are some distance above the ground level than when the gallery is so much sunk that the targets are level with the ground.

It is evident that the greater number of low shots which would ricochet off the ground in Plate 6, Figure 19, would be caught by the marker's shelter in Figure 20, in which the shelter stops practically all low shots except those which strike the actual crest.

A very good arrangement as regards ricochets is to sink the targets and cut out the ground between the gallery and the 100-yards firing point as in Figure 21, using the earth thus obtained to form the stop butt. This method, however, is more expensive and in many cases is unsuitable on account of the nature of the soil or difficulties in drainage.

24. The material with which the retaining wall and gallery are constructed depends on local considerations and the permanency or otherwise of the range. The retaining wall should, however, be bullet proof, *i.e.*, of brick or concrete 9 inches thick, and must be further protected by sand, earth or other material not less than 3 feet thick at the top. The face of this material should be sloped at 2 in 3 towards the firing points. *See* Plates 7 and 8.

25. The entrance to a sunken gallery should be by a ramp and not by steps, the former being more convenient for removal of targets and stores.

26. On certain sites a hillside may enable an artificial stop butt to be dispensed with. In such cases the ground in rear of the targets must rise at an angle of not less than 30 degrees to the general level of the firing points.

If the angle be less than 30 degrees the hillside should be scarped from a height of 2 feet above the targets to 1 foot below the lowest possible line of fire from the longest range firing point. *See* Plate 6, Figure 22. In cases where an ample danger area is provided this scarping is not absolutely necessary, and some form of bullet catcher, *see* Plate 6, Figure 23, on the face of the hillside may be substituted if economy would be gained thereby.

Stepping the hillside, though cheaper than scarping in one cut, is undesirable, as it tends to cause numerous and widely diverging ricochets, but it is permissible, if the nature of the ground is suitable and expense can be saved thereby, to form a butt partly by excavation and partly by embankment, so long as the faces of the excavation and bank are in the same plane.

27. On level sites where an artificial stop butt has to be provided, the height of the stop butt will depend on the level of the gallery and on the general lie of the ground ; 16 to 18 feet may be taken as the normal height ; 25 feet should not be exceeded. The stop butt should always show at least 2 feet above a first class target from all the firing points. The material and thickness of a stop butt are for local consideration. The length should be such as to project 20 feet beyond the outside edges of the flank targets, allowance being made in its construction for wear and tear due to weather and action of the bullets. If the only available site for the stop butt and gallery is on marshy ground, incapable of carrying a heavy earth stop butt, sloping steel plates may be used and special target frames entailing a minimum of excavation should be erected.

Full details of such a butt can be obtained from the Commandant, School of Musketry, Hythe.

28. In a stop butt composed of earth, sand, or shingle, the face need not be steeper than the natural slope of the material ; a slope of 2 in 3 is usually suitable. Layers of fascines placed at right angles to the slope assist in its preservation.

29. The distance of the stop butt from the targets will depend on the material used in its construction and on the nature of the hillside.

Fig. 19

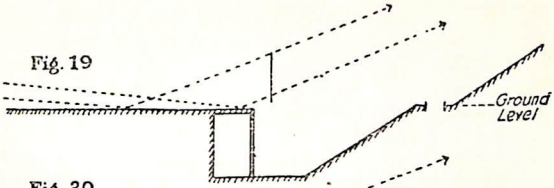


Fig. 20.

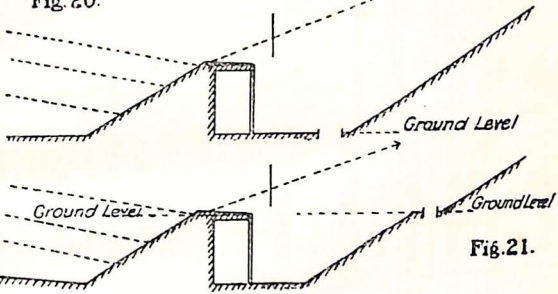


Fig. 21.

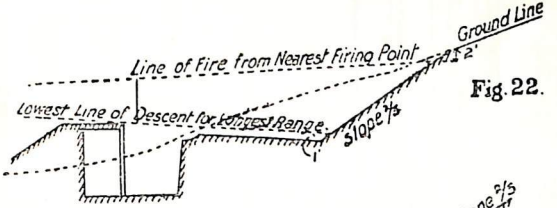


Fig. 22.

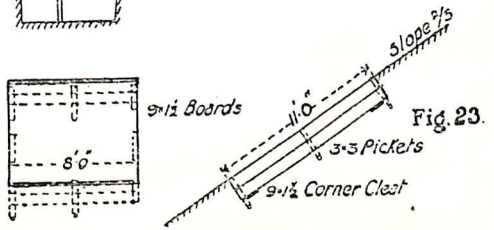
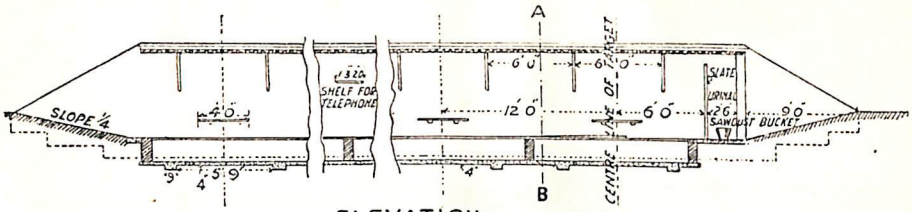
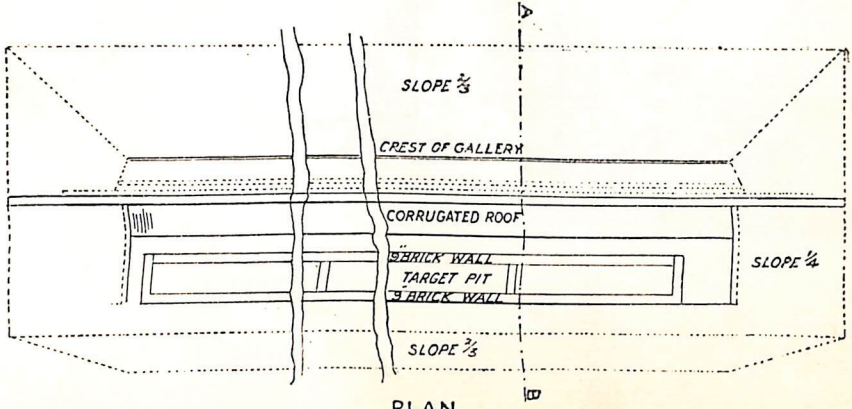


Fig. 23.

Type of Gallery.



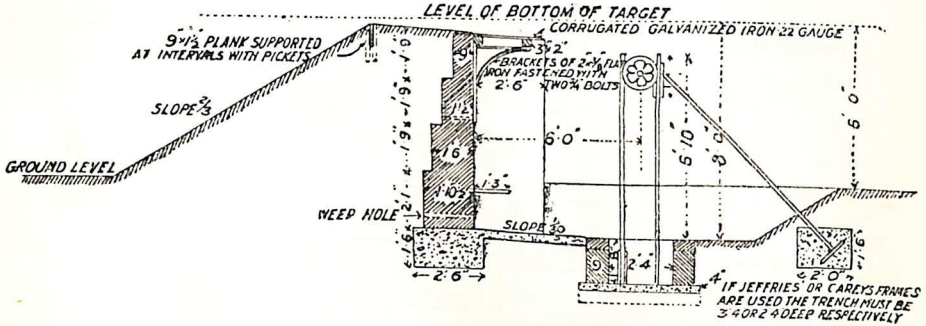
ELEVATION



PLAN

PLATE 7.

TYPE OF GALLERY.


LEVEL OF BOTTOM OF TARGET
CORRUGATED GALVANIZED IRON 22 GAUGE
9"x1½" PLANK SUPPORTED AT INTERVALS WITH PICKETS
BRACKETS OF 2½" FLAT IRON FASTENED WITH TWO ¾" BOLTS
SLOPE ⅔
GROUND LEVEL
WEEP HOLE
SLOPE 1/30
6'0"
5'10"
2'6"
2'4"
2'0"
IF JEFFRIES' OR CAREYS FRAMES ARE USED THE TRENCH MUST BE 3'4 OR 2'4 DEEP RESPECTIVELY

SECTION AT A.B.

PLATE 7.

Type of Gallery.

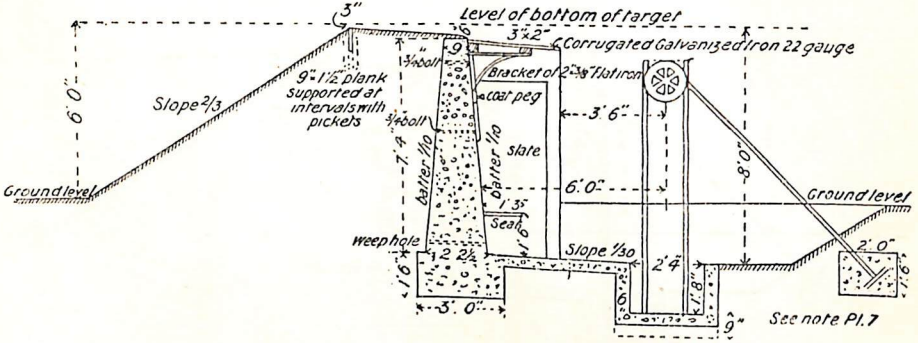


PLATE 8.

TYPE OF GALLERY FOR LONG RANGES.

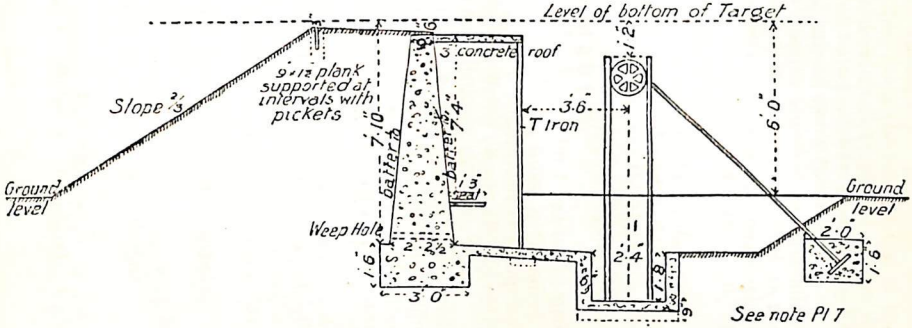
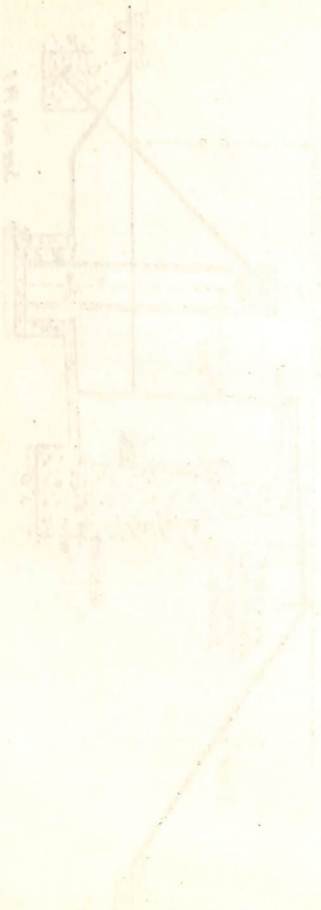


PLATE 9.



When formed of earth, sand or other soft material, it may be placed 20 or 30 feet from the targets. but if formed of shingle, or hard material, it should not be placed nearer than 90 feet from the gallery, and sand bullet catchers as shown in Plate 6 Figure 23, should be provided behind every target.

30. For all new ranges trenches or pits adapted to the prescribed firing positions should be provided immediately in front of the firing points for use in those practices which are performed from behind cover. *See* tables "A" and "B," Regular Forces, Musketry Regulations, Part I.

31. The firing points should be *on the ground level* if possible. Raised platforms are not to be provided except in the case of hollow or swampy sites or where the targets are not visible without them. In cases where they are required the width at the top should not be less than 9 feet.

32. When an artificial stop butt has to be provided it may be a question whether it will be more economical to build up the firing points or increase the height of the stop butts.

33. The length of the firing points should correspond with the number of targets and distance between them.

34. Each firing point must be accurately measured from the target and indicated by a picket with the range painted on it, pegs with the numbers of the targets being fixed on the firing points at intervals corresponding with the distance between the targets.

35. On small ranges of only one or two sections, temporary ranges, or where lateral space is ample, windmill targets may be employed. These targets are cheap and easily worked. They are not, however, suitable to ordinary ranges owing to the extra width required.

36. Under normal conditions the distance from centre to centre of targets should be 12 feet.

The most suitable target frame for normal sites is shown in Plates 134, *a*, *b* and *c*, W.O.P.B. The following points should be noted in erecting these frames :—

(i) Complete the side and end walls of the target pit and prepare the bottom of the pit to receive the concrete floor.

(ii) Bed 4 inch × 3 inch deal distance pieces, well tarred, as shown in the plates, with their upper surfaces ½ inch above the finished level of the floor. Holes must be left at each end of the distance pieces to receive the T-iron uprights.

(iii) Erect the frame, care being taken to keep it perfectly plumb and square. Then fill in the concrete round the foot of the uprights and windstays.

(iv Targets for these frames should be made of 3 inch × 2 inch scantling.

(v) The friction wheels and main axles should always be kept well oiled.

37. Ranges should be lettered and targets numbered from the left (looking from the firing point).

Numbers should be made of wood and placed on the stop butt in such a position that from the firing point each number appears to be resting on its target.

38. A flagstaff, 30 feet high, should be erected in a conspicuous place on or near the range for a large red flag, to notify that firing is going on ; a small flagstaff should also be fixed at one end of the gallery, in order that a danger flag may be hoisted from under cover when necessary.

39. A workshop will be required for the manufacture and repair of targets. A corrugated iron building as shown in Plate 10 is suitable for a classification range of 16 sections.

A target store, if necessary, will generally be built as a continuation of the marker's gallery. A lean-to shed with back and end walls of concrete and a corrugated iron roof will usually suffice.

40. (*a*) To obtain full advantage of the gallery system, permanent telephone communication is essential between the gallery and the firing points.

(*b*) The telephone circuits should in all cases be metallic circuits, and should as a rule be of 2-core lead covered and armoured cable (cable electric B. 2) buried at a depth of not less than eighteen inches.

(*c*) One telephone is sufficient for an eight section range.

CORRUGATED IRON WORKSHOP.

SECTION AB

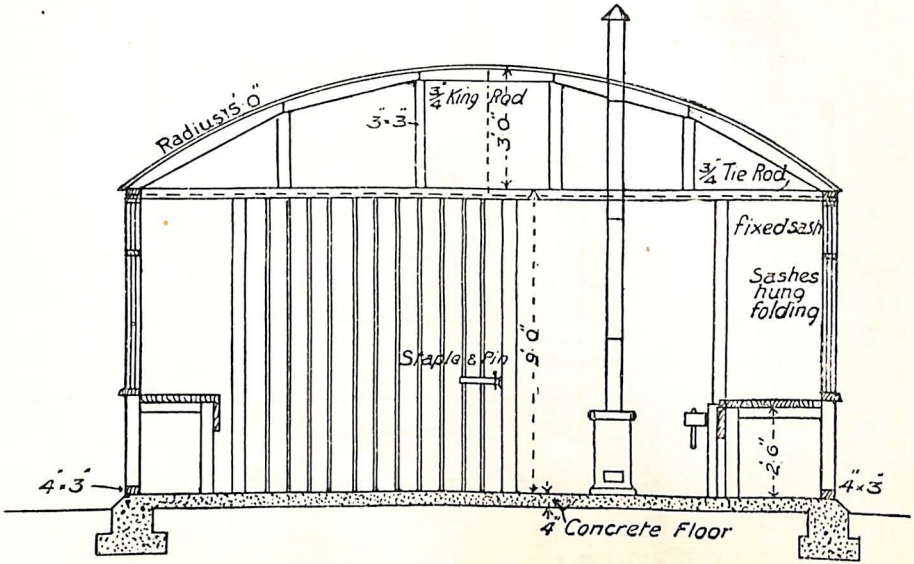
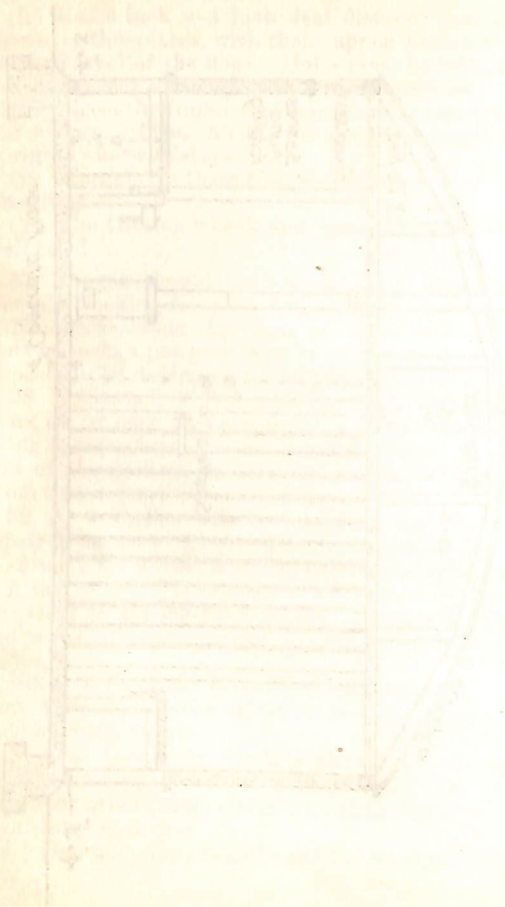
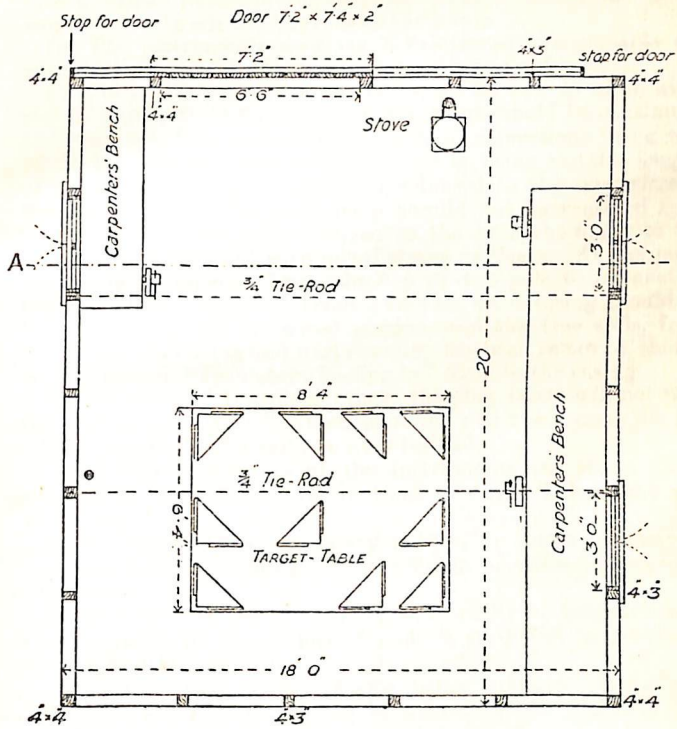


PLATE 10.




Stop for door
Door 7'2" × 7'4" × 2"
7'2"
4"×5"
stop for door
4"×4"
4"×4"
6'6"
4"×4"
Stove
Carpenters' Bench
A
B
3'0"
¾" Tie-Rod
20
8'4"
¾" Tie-Rod
6'4"
TARGET-TABLE
Carpenters' Bench
3'0"
4"×3"
18'0"
4"×4"
4"×3"
4"×4"

(*d*) At the butts the connection will be made by means of "Boxes, plug single." At each firing point the cable will be led into a "Box, junction, classification range." The cable should run direct between the boxes without joints.

(*e*) The instruments used are "Telephone sets portable C.," with "Plugs jack, W.D." to connect them to the boxes.

(*f*) If aerial lines are used they must be run so as to avoid risk of injury from bullets; the live wires should be continuous and terminated on insulators at the ends, connections being teed off at the various firing points and butts, using suitable lengths of the B.2 cable above mentioned, soldered to the live wires at the nearest pole. The armouring should not be removed from that portion of the cable secured to the pole, the fixing to the pole being carried out with metal straps or cleats. At the point where the conductors leave the top of the pole to connect to the live wires a length of about 3 feet of wood casing should be fixed enclosing the armoured portion, and the free ends, from which the armouring and lead covering has been removed, should be led through "Insulators, leading in" fixed to the casing.

(*g*) On some of the older ranges the plug boxes will not take the "Plug jack W.D.," which is round; in these cases the flat "Plug jack G.P.O." should be used instead.

(*h*) A full description of the instruments and stores above referred to is given in "Instructions in Army Telegraphy and Telephony."

(*i*) On ranges of a temporary nature, or where economy is essential, mirrors as shown in Plate 50 can be utilised in place of telephones.

41. The best site for the gallery will usually be determined by a consideration of paragraphs 16 and 19, as applied to the actual area of ground available.

42. The position of the targets being taken as the datum point, the firing points should be measured and picketed out, and the ground level taken at the several points.

43. A diagram can then be prepared from which the level of each firing point, the top of the target, and the height of the

stop butt, can be determined ; the level of the gallery depends on the height of the targets.

44. On ground falling towards the target it may not be necessary to prepare any diagram, but where, on an apparently level site, even slight undulations exist, such a diagram will greatly aid in the construction of the firing points, gallery, &c., and will help in the preparation of the estimate of cost.

45. In order to ascertain that all conditions have been complied with, it is desirable, before work is actually taken in hand, to :—

(*a*) Fix a dummy target, 1st class, in position for practice.

(*b*) Fix planks of timber to show level of top of markers' shelter and stop butt.

(*c*) Fix pegs to show position and level of firing platform.

CHAPTER III.

CONSTRUCTION OF 30-YARDS RANGES.

46. 30-yards ranges for use with service ammunition have been approved, having regard to the necessity of careful individual instruction in rifle practice—especially for indifferent shots—throughout the year, and to the advantages which practice with the service cartridge possesses over that with the miniature cartridge in accustoming men to the recoil and shock of discharge of the rifle and in admitting of rapid fire and snap-shooting. They are also advantageous in the earlier period of the soldier's instruction in cases where accommodation on open classification ranges is limited, or to obviate the loss of time involved in taking a recruit to such a range before he has shown on a 30-yards range that he has overcome common faults, such as flinching from the recoil, snatching at the trigger, &c.

47. These ranges are suited to all situations and to all classes of range practices, and should be constructed at all stations where there are sufficient troops to justify the expenditure.

Detailed drawings can be had on application to the Commandant, School of Musketry, Hythe.

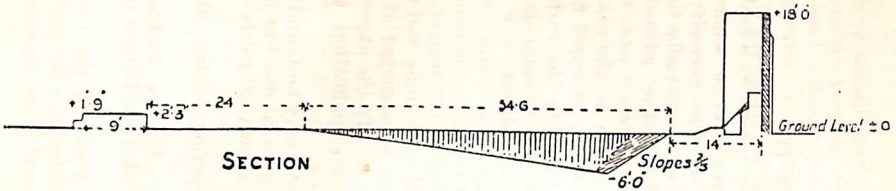
48. In the case of large garrisons it may be found necessary to establish one or more ranges for general use, but it is desirable that each corps should possess its own 30-yards range when possible.

49. When not required for instructional firing, 30-yards ranges may be used for company practice.

50. The procedure as regards the selection of sites for 30 yards ranges will be generally similar to that laid down in paragraphs 9–15 for classification ranges.

51. Due consideration must be given to the noise caused by the firing. This is considerably greater on a 30 yards range than on an open range owing to the sound being thrown back by the wall.

30 Yards Range.



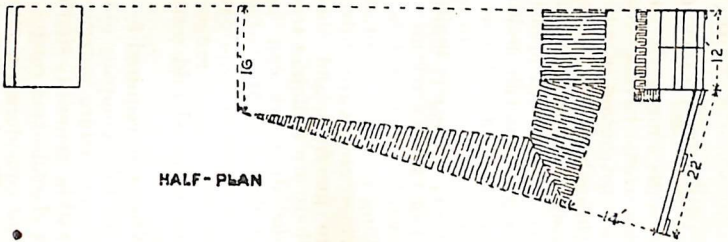


PLATE 11.

For this reason such a range should not be sited, if it can be avoided, within 400 yards of private residential houses, hospitals, or other buildings of a similar nature from which complaints of nuisance caused by the noise of firing might emanate.

52. It should be noted that, as the sound is thrown back by the wall, greater discomfort from the noise is caused to occupants of buildings behind the firing point than to those living in continuation of the line of fire. Therefore a site for a 30 yards range should afford a maximum of accessibility with a minimum of nuisance from the noise of firing.

53. If compatible with other considerations, the direction of the line of fire should be so arranged that the sun will be behind the firers at the time when firing usually takes place.

54. The 30 yards range (*see* Plate 11) gives protection against all shots fired within the following limits: Vertical deviation $8\frac{1}{2}$ degrees up and $7\frac{1}{2}$ degrees down. Lateral deviation 15 degrees to either side.

This protection is considerably greater than that afforded by the normal danger area on a classification range.

55. When a natural stop butt such as a vertical cliff, quarry, or wall of the necessary dimensions is available, a range can be very economically constructed by simply excavating a ricochet pit as shown in Plate 11. If this is impossible owing to the nature of the ground, the targets and the firing point should be raised to a height of 6 feet above the ground level. The stop butt should be vertical and the targets should be placed close up to the foot of the butt, as owing to the steep rise of ricochets at short ranges, a cliff which is not quite vertical ceases to be effective in proportion as the slope diminishes.

CHAPTER IV.

FIELD PRACTICE RANGES.

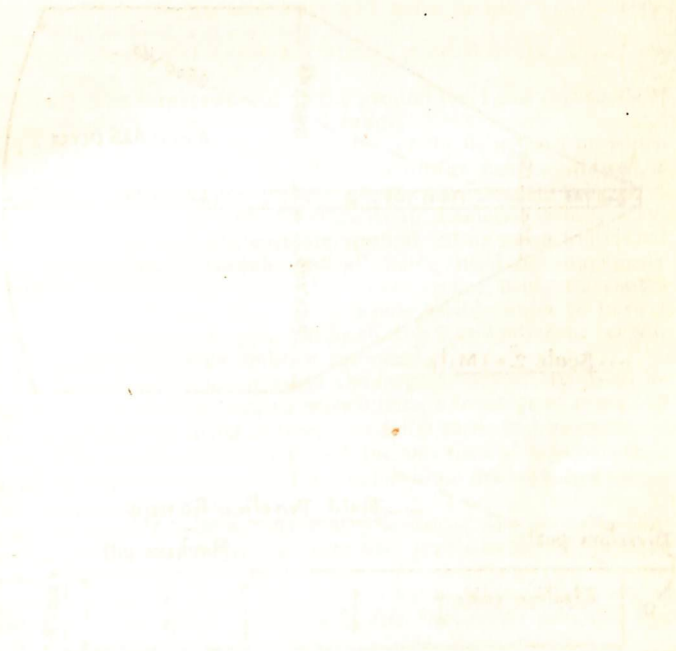
56. *General Considerations.*—In Part I Musketry Regulations, 1909, it is laid down that the general programme of field practices should be arranged as follows:—

(*a*) Individual field practices.
(*b*) Fire direction practices.
(*c*) Collective field practices, divided into :—
  (1) Exercises for half-companies and sections in fire direction and application of collective fire.
  (2) Standard tests of collective grouping and fire effect.
  (3) Comparative demonstrations of fire effect and vulnerability.
  (4) Exercises for companies designed to reproduce service conditions as far as possible, and to illustrate tactical principles.

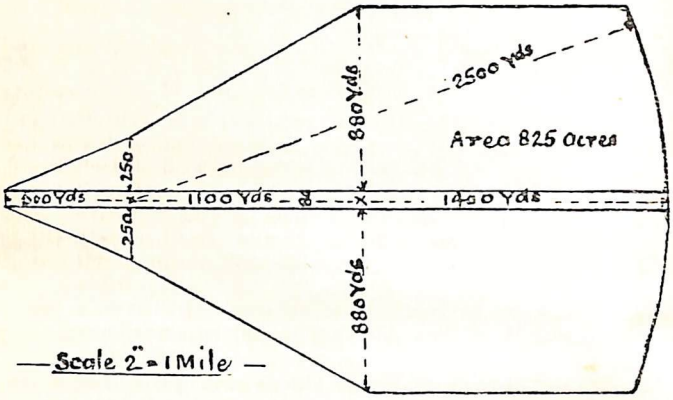
57. A field firing area should therefore provide for the above practices, and be designed so as to afford instruction of the greatest possible number of men in the shortest time.

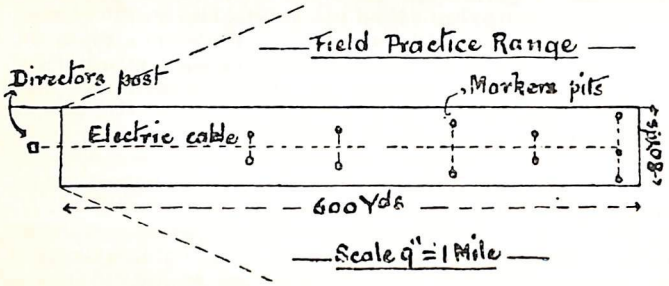
58. Ground to be suitable for field firing should possess a variety of natural features, but better instruction can be obtained on slightly undulating ground, on which there is, moreover, considerably less risk of the occurrence of widely divergent or long ranging ricochets, than on ground with more pronounced characteristics. It is easy to find concealment behind well-marked features, but to develop the powers to take full advantage of slight undulations demands constant practice. It would therefore appear that the best site for a field practice range is on ground generally open and level, but possessing some intersections and slight undulations of surface.

Marshy sites are unsuitable ; on rocky ground there is danger of erratic ricochets and splinters, &c. ; in thickly-wooded country the view is impeded, and expense must be incurred in clearing.



FIELD PRACTICE RANGE DANGER AREA.





59. *Danger Area.*—The danger area required for a field practice range must be considerably larger than that of a classification range for the following reasons :—

(i) There is no stop butt and consequently nearly every bullet fired will ricochet.

(ii) The line of fire is not always parallel to the axis of the range.

(iii) The targets appear at the ground level and this tends to produce ricochets at short range.

Thus it will be understood that for a field firing area on which complete latitude as to the direction of fire can be allowed, a large area of country is required. For an efficient field firing area a tract of country at least 4,400 yards in diameter is necessary. With such an area, on suitable ground 20 or more individual field practice ranges capable of all being used simultaneously could be sited radially round the circumference, using the centre as a common danger area. This would enable units to have a continual change of ground and by closing 2 or 3 adjacent ranges, larger bodies of troops could be exercised.

60. In ordinary circumstances the largest body of troops to be exercised will be two companies occupying a frontage of some 150 to 200 yards when firing at ranges of 1,400 yards and upwards.

61. The depth of area required for exercises of this nature is identical with that necessary for an individual field practice range, but the width is greater.

62. In order to prevent excessive diverging fire an individual field practice range for elementary field practices should be kept as narrow as possible.

63. A range 600 yards long and 80 yards wide enables about 8 men to be exercised at a time in the elementary practices and 15 to 20 in the more advanced practices at longer ranges.

The minimum danger area for such a range is shown on Plate 12.

The depth on normal level ground should be at least 2,500 yards from the most advanced firing position. If, however, the ground is undulating or hilly, so that the line of fire is at times inclined upwards, a depth of 3,000 yards should be obtained.

64. The minimum width required is 250 yards on each side of the end of the range and 880 yards on each side at 1,100 to 2,500 yards behind the range.

On ranges provided with this minimum danger area the greatest care must be exercised to prevent any diagonal firing, every man must only fire at targets directly opposite to him.

65. When the ground and other circumstances admit it is advisable to obtain a sector of a circle of 3,500 yards radius and 60 degrees included angle for the range and its danger area. When two or more ranges are to be sited on one area the same principles apply as are laid down for classification ranges in para. 18. Adjacent ranges must never be less than 250 yards apart.

66. It is intended that the firers may advance anywhere within the limits of the range itself.

67. For fire direction and collective fire practices when the ground admits of it, targets may be erected in the danger area in continuation of the axis of the range thus affording practice at ranges up to 2,000 yards.

68. *Construction.*—Stop butts and galleries are not required. It will merely be necessary to provide shelters for markers, target stores, workshops, and accommodation, if necessary, for range wardens. Shelters for markers on the individual field practice ranges should be large enough to accommodate two men sitting, should be built in inconspicuous positions, and, if possible, entirely out of sight of the firers. They must be sited so that the targets can be set up in front of and at a distance of from 5 to 10 yards from each shelter ; these targets should be in full view of both firers and markers, so that they may be lowered when hit ; *see* Plate 13.

69. The shelters should be arranged in pairs, so that four targets may be worked from each pair of shelters in individual practices, or eight in more advanced exercises. The lateral interval between two shelters should be from 10 to 40 yards, and four or five pairs of shelters at varying ranges should be placed on each range. For use with the disappearing target shown in Plate 43, light

Shelter for Markers—Field Practices.

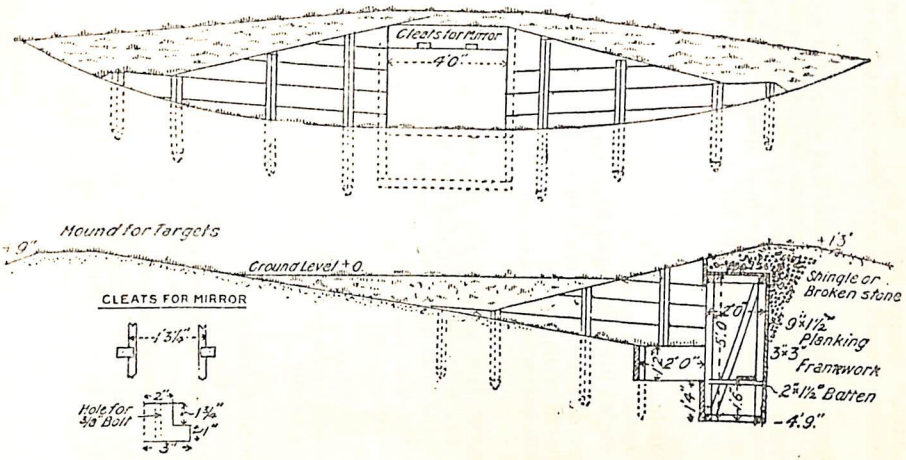


PLATE 13.

wooden frames on which to place the targets should be fixed close up to the shelters to enable the markers to show the position of hits.

It is desirable that each individual field practice range should have a system of electrical communication, in order that the director of the practice may be able to cause the targets to be raised and lowered at will, and to enable the practice to be carried out with a minimum of delay. The system should normally be designed as follows:—

A bell operated by a generator from the directing post, behind the firing point, is required in each shelter to control the raising and lowering of the targets. For the normal range a single circuit with all the bells connected in parallel will suffice.

The main cable should be laid from the directing post down the centre of the range. At each row of shelters branch cables should be led off, leading to the shelters on either side of the main cable.

A code of rings is arranged for raising and lowering the targets, all the shelters in a row being operated together. Where more than five rows of shelters are required, they must be arranged so that there are not more than five rows on one circuit; if this cannot be done, additional cables are required.

Where two or more ranges are controlled from one directing post, it will generally be sufficient to have one generator only, and to connect the generator to the cable required by means of a switch.

It will usually be desirable to provide a telephone at the directing post, which can be connected to the line when required, to communicate with another telephone placed in any one of the shelters in lieu of the bell in that shelter.

If the position of the shelters is liable to alteration, the branch cables should be cut to the maximum lengths likely to be required. The slack of the cable should be coiled in the pit, or buried.

The stores required for a typical field practice range with eleven shelters are :—

Cable, electric, "C 1," etc.	As required
Boxes, cable, rifle range	5
Brackets, bell or telephone	12
Bells, electric, magneto "R"	10
Cases, bell, bracket	10
Generators, magneto "A"	1
Telephone sets, portable "C" complete with cells	2
Plugs, jack, W.D.	3

70. Each individual field practice range should be clearly marked out by four posts, one on each side of the longest range firing position and one on each side of the shortest range firing position, beyond which no firing should be allowed.

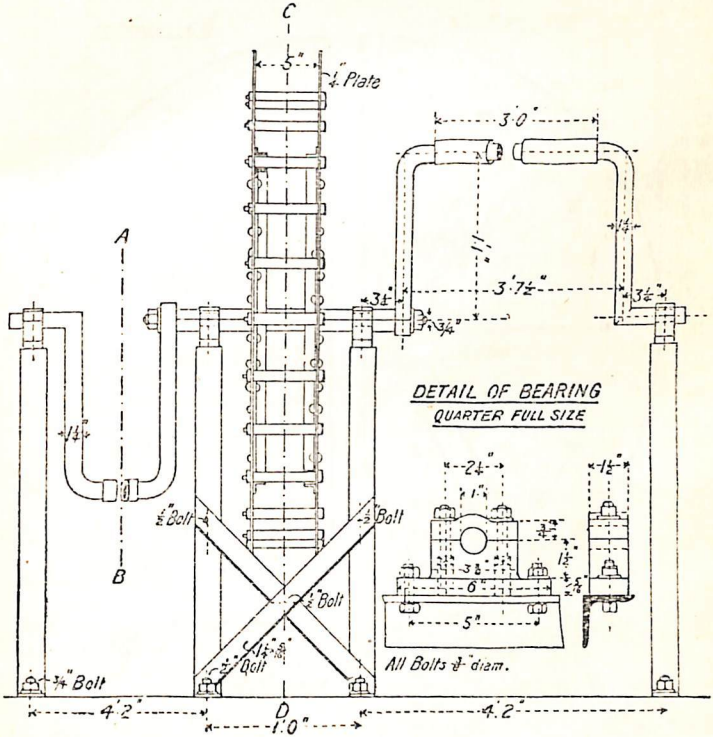
71. Permanent firing positions and cover should not be erected. Men should make use of features of the ground, and each individual should construct cover for himself when natural cover is not available; but this cover should be levelled before leaving the range. Entrenching tools should be provided for this purpose.

72. A light hand cart is required on each range for transport of targets. Sheds for field practice targets built of light corrugated iron sheets on wood framing should be provided at the rate of 1 for each pair of individual field practice ranges.

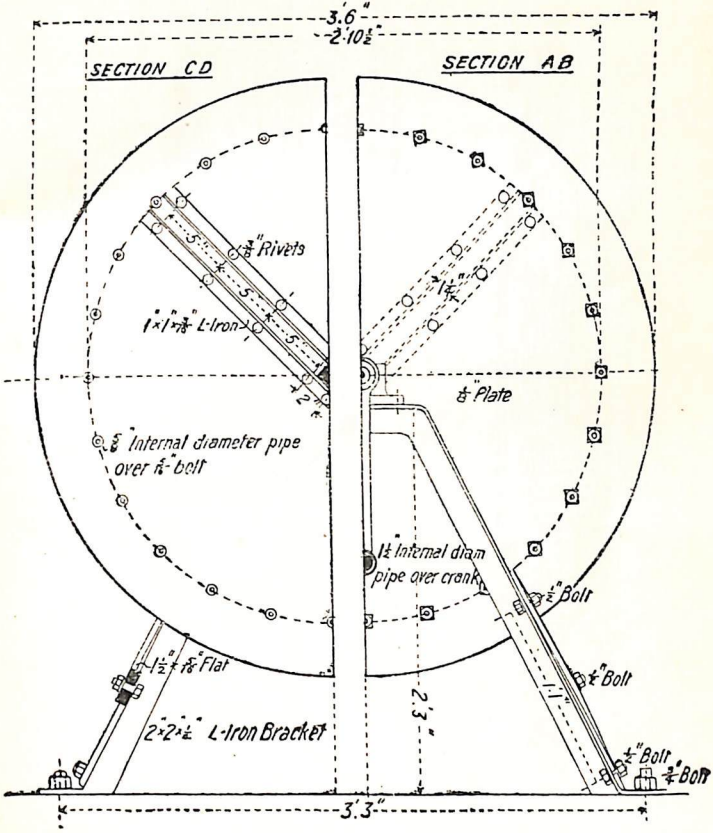
73. Workshops for manufacture and repair of targets, built of similar material, should be provided at suitable positions. Fifty per cent. of spares should be stocked in order to obviate delay through shortage of targets.

74. Plate 14 shows detail of a winding drum suitable for working sledge targets as described in para. 172, and Plate 15 shows a suitable shelter so that the fatigue men working the drum may be under cover.

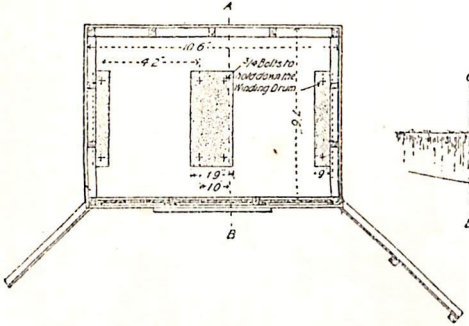
Drum for Working Sledge Targets.

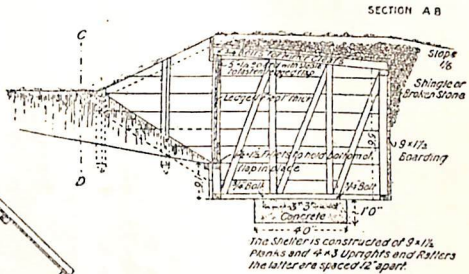


Drum for Working Sledge Targets.



Shelter for Men Working the Drum.





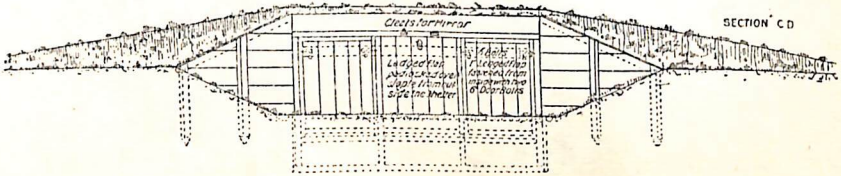


PLATE 15.

CHAPTER V.

MINIATURE CARTRIDGE RANGES (·220 BORE).

I.—General Instructions.

75. Miniature rifle clubs are entitled to free inspection by competent military authority of all their ranges, provided that they are affiliated to one of the rifle club associations to which official recognition has been accorded.

The titles of all such organizations are communicated to General Officers Commanding.

Secondary Schools are entitled to the free inspection of ranges provided for the use of the School Rifle Club.

76. Miniature cartridge ranges will be established for the Regular Forces at all depôts and will be administered by the officer in charge of musketry duties.

77. The General Officers of Commands are authorized to approve all miniature cartridge ranges constructed in accordance with the instructions given in this pamphlet.

78. The inspection and approval of miniature cartridge ranges constructed for rifle clubs or schools should only be undertaken on application from the secretary of the society to which the clubs are affiliated, or, in the case of secondary schools, from the headmaster of the school.

79. Should there be any doubt as to the safety of the range the General Officer Commanding will refer direct to the Commandant, School of Musketry, for his views and advice.

80. Travelling expenses necessarily incurred by officers engaged in the inspection of miniature cartridge ranges for rifle clubs may be borne by army funds.

81. Formal approval of miniature cartridge ranges for rifle clubs will be conveyed to the secretary of the society, or, in the case of secondary schools, to the headmaster, by means of a certificate, of which a copy is appended. (A.F. K 1314.)

II.—Instructions for Inspection of ·220 Ranges.

(*A*) Ranges for Regular Troops or Units of the Territorial Army.

82. When it is proposed to construct a new miniature cartridge range for regular troops or units of the Territorial Force, or to alter an existing one, the question will be submitted to the General Officer Commanding with a report on Army Form K 1311 giving such information on the following points as may be required, with due regard to local conditions :—

For Outdoor and Indoor Ranges.

(i) Name and situation of range.
(ii) Detail of corps to use the range.
(iii) Length of range (in yards).
(iv) Number of targets to be provided.
(v) The system of marking to be adopted.

For Outdoor Ranges only.

(vi) If a danger area, over which it is proposed to obtain firing rights, is to be obtained, the nature of the soil and the length and breadth of the area is to be given, and it should be stated—

SPEC

OF CERTIFICATE AWARDED TO MINIATURE CARTRIDGE RANGES

For Office File No. ——

No. 1.

CERTIFICATE.

SAFETY OF A MINIATURE CARTRIDGE RANGE.

Command_____

District_____

Place_____

Name of Range_____

Indoor or Outdoor_____

Name of owner or Name of Club Secretary _____

To whom issued_____

Date of issue_____

By whom signed_____

Reference to Office File_____

Perforated in original.

No. 1

CERTIFICATE.

SAFETY OF A MINIATURE CARTRIDGE RANGE.

Command_____

District_____

Place_____

Name of Range_____

Indoor or Outdoor_____

Name of Owner or Name of Club Secretary _____

To whom issued_____

Date of issue_____

By whom signed_____

The undermentioned Plans, Documents, &c., are referred to in the Certificate issued. Duplicates, marked with the above number, are in this File.

No.

Plans_____

Report_____

Other Papers_____

Perforated in original.

I M E N

FOR SCHOOLS AND RIFLE CLUBS REFERRED TO IN PARA. 81.

Army Form K 1314.

CERTIFICATE. **No. 1.**

SAFETY OF A MINIATURE CARTRIDGE RANGE.

Schedule of Plans and Documents referred to below, marked with above number and hereto annexed.

Command_____	Name of Range _____	Plans_____
District_____	Indoor or Outdoor_____	Report_____
Place_____	Name of Owner or Name of Club Secretary _____	Other Papers____

The above range has been inspected, and, as regards the structural arrangements, which are shown and described in the annexed Plans and Report, it conforms to the rules laid down as to the safety of W.D. Ranges of similar character.

It must be borne in mind, however, that the safety of all Ranges depends not only upon structural considerations but also upon—

A. Discipline, Care and Skill at the Firing Points, and

B. Precautionary measures regarding access to any Areas, Spaces, Roads or Paths—whether in front of the Targets or behind them—where Danger may be apprehended.

Whilst the War Office accepts the responsibility of advising as to the structural safety of the Range, and also as to the "Precautionary Measures" alluded to under "B" above, the ultimate responsibility for the said "Precautionary Measures," as well as the entire responsibility for "A" and for all other matters connected with the use of the Range, must necessarily rest with the owners and users of the Range.

Particular attention is drawn to the *General Conditions of Safety* laid down in the Instructions for Construction of ·220 Ranges and to the special conditions embodied in the Report above mentioned, and also to the following general instruction:—

"No one shall be allowed to fire beyond 25 yards who is not, in the opinion of someone competent to judge, sufficiently skilled to justify his being allowed to fire at longer Ranges." (*See* para. 104 Musketry Regulations, Part 2.)

It must be distinctly understood that this Certificate holds good only so long as the arrangements shown and described upon, and in the Plans and Report hereto annexed are maintained. Any alteration in the Structural Arrangements, made without reference to the office from which this Certificate is issued, will render the Certificate null and void.

Date of issue_____ Signature_____

To—

Name _____ _____General i/c Administration.

Whether Owner, Club Secretary, &c._____ _____Command.

Address_____

(*a*) Whether the area is to be purchased or leased, or whether firing rights only are to be obtained. In the latter case the proposal is not to be submitted until the consent of the owners or occupiers of the land is secured.

(*b*) What arrangements are proposed for preventing persons from entering the danger area while firing is in progress.

(*c*) Whether the danger area is free from buildings, railways, roads, paths, &c.

(vii) The length, height, thickness and material of the stop butt.

(viii) A portion of a 6-inch Ordnance Map, shewing the range, firing points, stop butt and danger area (if any), contoured to 25-foot interval, will accompany the report, whether a danger area is proposed or not. The map will include all ground within 1,000 yards in rear of the butts and 100 yards outside the flank targets.

For Indoor Ranges only.

(ix) A pencil sketch (or plan and section) of the range is to be attached, giving the heights of the walls and the section of the roof. The position of all doors, windows, and skylights should be shewn, and the material (giving thicknesses) of which the building is composed should be stated.

(x) The thickness and nature of the stop butt.

(xi) It should be stated whether all openings such as doors and windows which it is necessary to protect are carefully and efficiently masked.

(xii) The arrangements made to guard against splinters.

(xiii) The lighting arrangements.

(xiv) The nature of the ground or floor of the range.

83. The General Officer Commanding will careful'y consider this report, and, if necessary, cause the range to be inspected by a

member of his staff. After satisfying himself that the instructions for the construction of miniature cartridge ranges contained herein have been complied with, and that funds are available, he will give sanction for the work to be carried out. In the case of miniature ranges for the use of the Territorial Force, the correspondence will follow the channels indicated in para. 15.

(*B*) Ranges for Rifle Club.

84. On receipt of an application from the secretary of one of the societies or schools mentioned in paragraphs 1 and 2 for the inspection of a miniature cartridge range designed for the use of rifle clubs, the General Officer Commanding will arrange for the inspection of the range by an officer of the regular forces.

This officer will submit his report on the form specified in paragraph 82, attaching the plans and sketches therein referred to, which will be prepared by him.

Approval will be given on the forms, and subject to the conditions, specified in paragraphs 81 and 83. In such cases, however, no financial questions arise.

III.—·22 inch Rifles and Aiming Tubes.

85. In selecting a rifle for use on a miniature range, a pattern should be adopted which approximates as nearly as possible in length, weight, sighting arrangements, bolt and trigger action to the service rifle. It is only if this principle is adhered to that practice with miniature rifles can be looked on as a satisfactory preliminary or accessory to practice with the service rifle.

A description of the service ·22 inch short rifle and of the aiming tubes suitable for use in a service rifle is appended.

The Short Rifle, ·22 inch Rim-fire, Mark I.

86. The rifle is bored and chambered to take the rim-fire aiming tube cartridge, Mark I ("long" ·22), but is made to approximate

as closely as possible in weight and external appearance to the Service Short rifle.

The rifling is segmental, of the Metford type.

The action of the mechanism is identical with that of the service rifle except that the striker is eccentric to enable it to explode the rim-fire cartridge. The bolt head is liable to fracture and should not be brought back against the resisting shoulder with unnecessary force.

No magazine is fitted, but the space for it in the bottom of the body is left open, so that empty cases after extraction fall through and there is no necessity to turn the rifle over to get rid of them.

The double pull off is fitted, as in the Service Short rifle, and the sights are the same as those of the latest pattern of that rifle, viz., a blade foresight and a backsight with U notch, the latter being fitted with a windgauge and with a fine adjustment for giving small increases or decreases of elevation.

The long range (aperture and dial) sights are not fitted.

The bolt is removed for cleaning by drawing it back, releasing the bolthead from the retaining spring by pressing it upwards, and raising the bolthead as far as it will go. The bolt can then be withdrawn.

The bolt is replaced by reversing this operation.

If it is necessary to strip the bolt, the bolthead will be removed and the front end of the striker gripped in a vice with suitable protecting claws. The cocking piece will then be unscrewed from the striker. The bolthead must not be used for stripping the bolt as is done with the Short Lee Enfield service bolt.

Aiming Tubes for Short and Long Lee Enfield Rifles.

87. The tubes are of steel, rifled with eight flat-bottomed grooves. As they are adapted for use with the rim-fire cartridge they can only be used with the special bolt in which the striker is eccentric.

The instructions to be followed in fitting the tubes are as follows :—

Remove the bolt as described for the Short rifle, ·22 inch, R.F. ; unscrew the nut at the muzzle end of the tube and remove the gun metal and leather washers. Insert the tube in the barrel from the breech end, placing it in such a position that the projection on the end of the sliding extractor coincides with the extractor way in the barrel. Replace the washers and screw the nut up tightly by hand. Replace the bolt.

If the tube is fixed correctly in the barrel the extractor on the bolthead should leave the sliding extractor of the tube after withdrawing it about 7/16ths of an inch from the face of the chamber. Neglect to fix the tube in the proper position may render it unserviceable.

To remove the tube from the barrel, reverse these operations.

The bolt will be stripped in the same manner as the bolt of the short rifle, ·22 inch R.F.

Cleaning ·22 inch Rifles and Aiming Tubes.

88. As a foul rifle shoots very inaccurately it is of the utmost importance, from considerations of safety, that the barrel should be frequently wiped out during use.

The brush will invariably be inserted from the breech end. If it is inserted from the muzzle the friction of the rod will make the muzzle bell mouthed, thus causing inaccuracy.

The War Office Miniature Rifle.

89. The rifle is on the bolt principle and is about 4 inches shorter and considerably lighter than the Service Short rifle. It is bored and chambered to take the rim-fire aiming tube cartridge, Mark I ("long" ·22).

The rifling is segmental, of the Metford type.

Though the bolt differs from that of the Short rifle, ·22 inch R.F., previously described, the action of the mechanism is much the same.

A magazine is fitted which holds 5 cartridges. In charging the magazine the base of the cartridge is pressed down on the magazine platform and the point of the bullet then allowed to fall forward. Care must be taken that the base of the cartridge is held down by the shoulders at the rear end of the magazine.

The magazine is removed by pressing the catch which will be found under the stock, between the magazine and the trigger guard. The bottom of the magazine can be removed by sliding it to the rear, when the spring and platform can be taken out.

The foresight is of blade pattern and is fitted with a hinged sight protector, and the backsight has a U notch and a slide which rests on a curved ramp and which can be adjusted to give any elevation required. Lines are marked on the leaf shewing the elevations necessary for 25, 50, 100, 150 and 200 yards. A windgauge is fitted in the cap of the backsight and is adjusted by milled head screws.

The bolt is removed for cleaning by pressing back the trigger as far as it will go and withdrawing the bolt.

IV.—·220 Ammunition.

90. The types of ·220 ammunition made by different manufacturing firms vary considerably in power. It must be borne in mind that the long ammunition, as generally used, containing 4 to 7 grains of powder and a bullet weighing 40 to 45 grains, with a muzzle velocity of 900 1,300 feet per second, has considerable power, and suitable precautions must be taken to ensure complete safety.

The following penetrations have been observed with long ammunition :—

Soft deal	.. .. ..	$4\frac{1}{2}$ inches
Oak	.. ..	$1\frac{1}{2}$ "
Sand	.. ..	8 "
Earth	.. ..	5 "

$\frac{1}{8}$ inch steel plate is dented at 25 yards and is penetrated by several shots striking the same spot; but it is proof against occasional shots and gives quite sufficient protection when it is liable to be hit by accidental shots only. For a position directly behind the targets $\frac{1}{4}''$ steel plate should be used.

3 inches of fine shingle between boards is proof against ·220 ammunition.

V.—·220 Ranges. Outdoor.

91. An outdoor range is undoubtedly the best type of miniature cartridge range. The light is natural, the effect of wind is appreciated, and the conditions generally are more natural than on an indoor range. On the other hand practice is interfered with by inclement weather and firing can only take place during the hours of daylight. These disadvantages can sometimes be overcome by covering in the firing point, but if it is necessary that much practice should take place during winter evenings an indoor range should be provided if possible in addition to an outdoor range.

92. It will often be found possible to construct an outdoor range, with very little expense, in a disused quarry or chalk pit, or against a cliff or blank wall. A range on which it is proposed to use ·220 bore rifles must be provided either with an efficient stop butt or with a danger area behind the targets of the following dimensions:—Depth (measured from the targets), 700 yards; width, 80 yards on each side measured from the flank lines of fire.

Thus, for a one-target range, the normal danger area measures 700 yards in depth by 160 yards in width; but for a range of 12 targets spaced at three foot intervals from centre to centre the normal danger area is 700 yards in depth by 160 yards plus 11 × 3 feet = 171 yards in width.

93. It is necessary to obtain the consent in writing of all the owners or tenants of the land in this danger area to the construction of the range, and steps must be taken to see that no person enters the danger area while firing is in progress.

94. The area should contain no dwelling houses nor should it be crossed by any main road or other channel along which there is considerable traffic. Lesser roads, paths, rights of way, &c., along which there is little traffic, do not constitute an absolute objection to a range, but they are very undesirable, as look out men with flags have to be provided to watch them while firing is going on, and firing must be stopped while persons are within the danger area. These conditions, though at times easily obtainable in the outskirts of country villages, are, as a rule, impracticable in the outskirts of towns, where resort must be had either to a large stop butt or to a closed-in range. Although when a danger area is available, a stop butt is not an absolute necessity, it is very desirable, and should be at least 6 feet high and 5 feet clear outside the flank targets. It should be borne in mind that the chief source of danger on all ranges is the ricochet and every effort should be made to catch all bullets at the target.

95. Where no danger area is available, an open range up to 100 yards in length may be constructed provided that a stop butt of the following dimensions be provided.

For ranges not exceeding 50 yards in length :—

Height 12 feet, width 6 feet clear on either side measured from the flank lines of fire.

For ranges exceeding 50 yards, but not exceeding 100 yards in length :—

Height 15 feet, width 10 feet clear on either side. In the latter case when the country for 700 yards behind the stop butt is open and there are no houses or main roads behind the butt within that distance, the dimensions given above for the stop butt may be reduced at the discretion of the inspecting officer to 12 and 8 feet respectively.

Thus for a 100 yard range in a populous district with 6 targets, 3 feet apart from centre to centre, a stop butt 15 feet high and 35 feet long would be necessary.

96. It must be clearly understood that the dimensions given above for the stop butts are minimum dimensions and strict discipline must always be exercised at the firing points to avoid all risk of accident. If possible, it is advisable to somewhat increase these measurements, especially when the ground behind the stop butt is much frequented.

97. When an artificial stop butt is necessary, it may be constructed of any convenient bullet proof material. A brick or concrete wall, a foot of earth or sand, 6 inches of gravel, 3 inches of shingle or granite chippings held between planks, old sleepers or other material, or $\frac{1}{8}$ inch steel plate on timber supports, are all proof against occasional shots. Additional protection should in all cases be given immediately round the targets for a distance of at least one foot radius from their centres. An eighth of an inch steel plate will soon be penetrated if continually hit on the same spot. This extra protection may be provided for by means of a bullet catcher of inclined steel plates on the louvre system or an additional $\frac{1}{4}$ inch plate or a box filled with shingle, gravel or sand.

98. The main feature upon which the safety of these ranges depends is the vertical butt situated immediately behind the targets. If the butt is not vertical, but consists of a sloping bank of earth, or if the vertical butt is situated 10 or 20 feet behind the targets, the factor of safety is considerably reduced both as regards the angle of safety against direct shots going over the top of the butt, and also as regards the angle of safety provided against ricochets which have struck the ground just short of the targets ; it is this latter factor which is most frequently overlooked and which needs special attention.

99. If a natural bank or cliff is used as a stop butt, the targets should be placed as near to the foot of the slope as possible. The slope of the ground should not be less than three over two for a height equivalent to the required stop butt. To ascertain this

height, erect a 12 or 15 foot rod (as the case may be) vertically at the targets and note the point where a straight line drawn from the ground level at the nearest firing point through the top of the rod cuts the bank. (*See* Plate 16.)

To be equivalent to a vertical stop butt, the slope must be at least 3/2 from the targets to the point thus found.

100. If the total effective height of the hill, *i.e.*, the perpendicular distance from the line of sight produced to the top of the hill, exceeds 80 feet the range may be considered safe provided that the slope of the ground exceeds 1/1.

101. The line of sight should if possible be level or slightly downhill. Ranges with uphill lines of sight require extra precautions and should be avoided. If other considerations permit, the targets should face South to obtain a good light. Other circumstances may sometimes call for special precautions. For instance, suppose that, on a site on level ground, it were desired to place the stop butt against a main road and fire towards the road, and suppose the boundary of that road to be an ordinary hedge or a wire fence. Any traffic passing by would be absolutely safe while it was behind the butt, but might be hit by an accidental shot right or left, and though such an accidental shot would not merit consideration in the open country, it is absolutely necessary to provide against it where a main road is close behind the butts. The site in question would therefore be a most undesirable one. If, however, the road was bounded by a 9 foot wall extending some distance right and left of the targets there would then be no objection to the site provided that the usual 12 or 15 feet of height over the prescribed width was provided, since all traffic on the road close behind the butts would be completely defiladed by the 9 foot boundary wall.

102. Firing through loopholes or screens of any sort is to be deprecated. Such erections hamper the firer in the free use of his rifle, and interfere with his view of the targets. Bullets will often ricochet off their edges.

103. Members of rifle clubs should always be given careful instruction in aiming and snapping with an empty rifle before being allowed to fire.

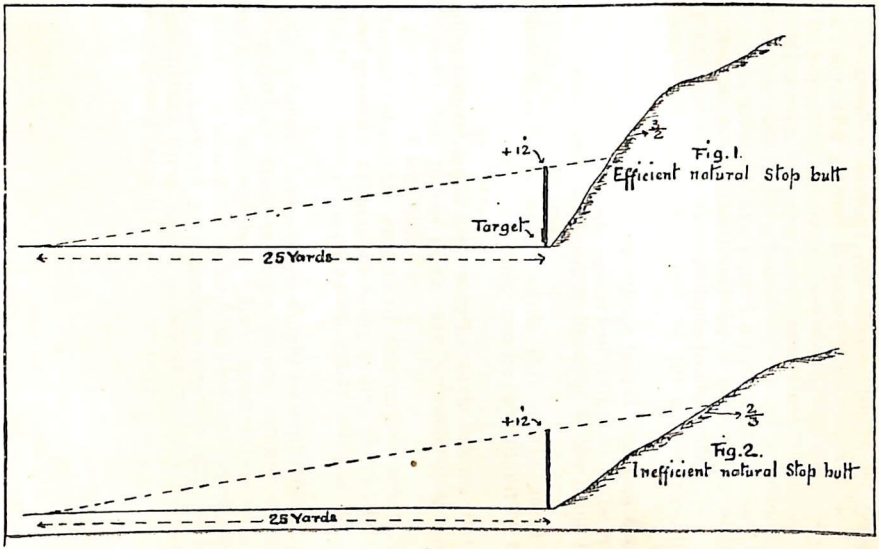
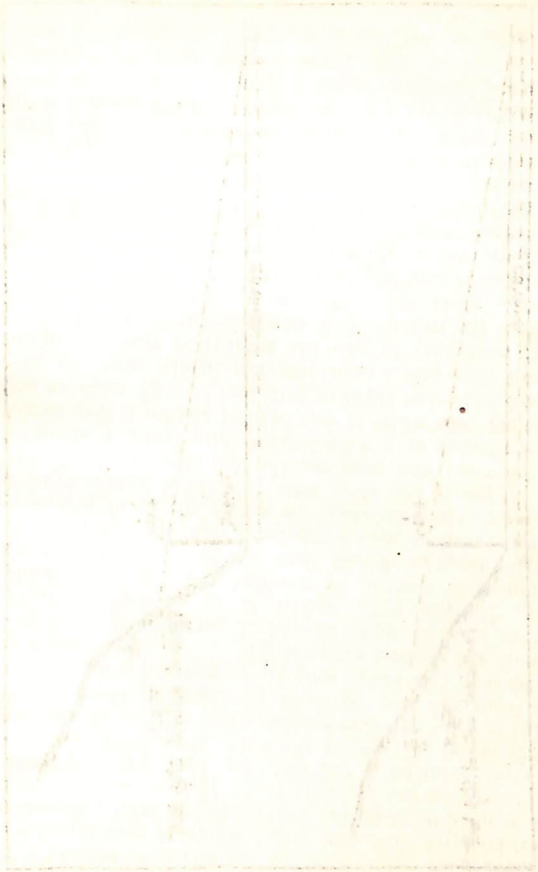

+12'
Target
25 Yards
Fig.1.
Efficient natural stop butt
+12'
25 Yards
Fig.2.
Inefficient natural stop butt

PLATE 16



104. No member without experience should be permitted to fire on a range at a greater distance than 25 yards, and no firing should be permitted on any miniature cartridge range, unprovided with a danger area, at a greater distance than 100 yards.

No member should be allowed to fire at a greater distance than 25 yards until he has passed a test of proficiency in shooting at this distance, conducted by a committee of the club officials, and has received a certificate to that effect.

The required standard should be 20 consecutive hits on a target six inches diameter.

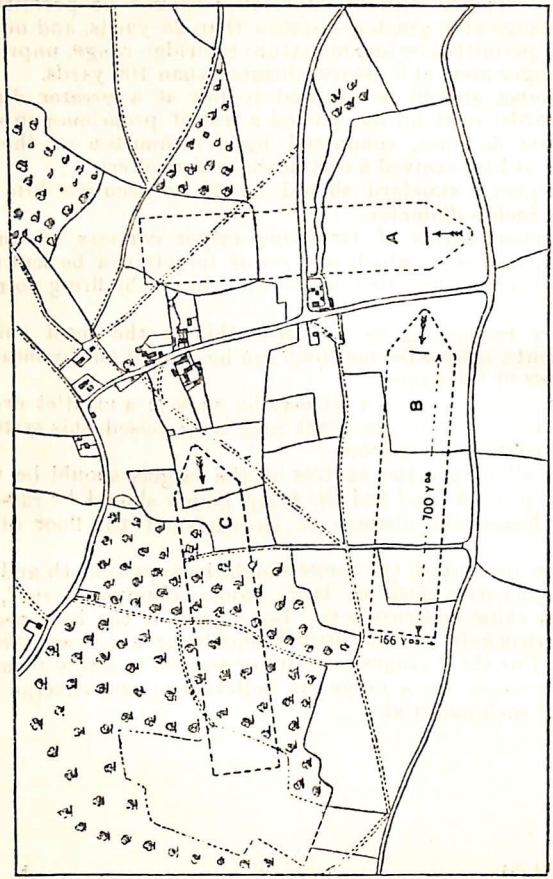
105. Various forms of travelling target carriers are on the market, by means of which one set of targets can be sent down to the butt while the other set is brought to the firing point for checking.

106. For ranges up to 25 yards this is the most suitable arrangement; otherwise marking can be carried out by means of field glasses or telescopes.

107. For longer ranges a pit may be sunk or a mantlet erected for the marker, but unless great care is exercised, this system is a fruitful source of accidents.

108. On all ranges the centres of the targets should be three feet above ground level and the firing points should be raised 18 inches to lessen the chances of ricochets off the floor of the range.

109. The ground of the range should be kept smooth and free from irregularities such as large stones, clumps of turf, &c., which may cause bad ricochets. Long grass is the best preventative of ricochets and its growth should be encouraged where possible. For short ranges asphalte or smooth concrete forms an excellent surface for a range, as bullets rise and diverge very slightly off such material.



Scale, $3\frac{5}{8}$″ to 1 mile.

VI.—Types of Outdoor Ranges.

110. Plate 17 is a reproduction of a portion of a 6-inch Ordnance Map, having marked on it three proposed sites for miniature ranges, which are intended for use without large stop butts. These sites are marked A, B and C, and in each case the position of the targets is shown by a plain line, and the direction of the proposed line of fire by an arrow. The boundaries of the danger areas, viz.: 700 yards in depth and 80 yards in width beyond the flank lines of fire, are in each case drawn in in dotted lines.

111. Of the above three proposals site A is the most undesirable for the following reasons:—There is a main road crossing the danger area at about 350 yards behind the targets, there is also a footpath crossing it diagonally, though further off, and finally there is a block of houses quite close to the boundary of the danger area. In this case, although firing rights might be obtained from the owners of the fields actually in the danger area, yet firing would have to be stopped while persons were crossing the danger area either by the main road or by the footpath, and this would probably necessitate the placing of two or more look-out men with flags near the road and path in question in order to signal to the firing point when any persons were about to cross, But besides the delay and inconvenience occasioned by this there is always a grave objection to siting an open range with its boundaries close up to buildings, where there are probably children who cannot be kept away from the danger area.

112. As regards B, this proposal is a material improvement on A; there are no footpaths crossing the danger area, although there is one private cart road which leads to a copse but does not go beyond; doubtless arrangements could be made so that this road should not be used while firing was going on.

This site, although it is such as might be passed were there no better site available, is, however, not a very desirable one, since the main road on the south and the footpath (which is a very

convenient short cut to the village) are much used, and are not very far from, and extend practically all along, the lateral boundaries of the danger area.

113. Site C is far the best of the three: the line of fire is well away from any houses or main roads, and the three paths shown are private paths, not rights of way, and can be closed by the owner of the wood.

114. Sites B and C are good examples of cases where, if no danger area were obtained and a large stop butt were erected, the height of the stop butt for a 100 yards range might safely be reduced to 12 feet. On site A this reduction would not be advisable.

115. Plate 18 is an example of an outdoor range having a hill stop butt. Contours are shown at 10-foot vertical interval. On such a site as this it is desirable to have two separate lines of fire. The line of fire from the 100 yards firing point to the targets is quite satisfactory as such, and a firing point at 50 yards can also be erected on the same line, since as the 100 yards firing point is well above the 100-foot level a clear view is obtained from each firing point. But, as has been mentioned before, an uphill line of sight is always undesirable. If the 50 yards firing platform is three feet above ground, thus bringing the rifle of a firer to the 93-foot level, and the targets are, say, at 102 feet (*i.e.*, 3 feet above ground level), then there is a rise of 9 feet in 50 yards or of 3 in 50. Now the 150-foot contour may be taken as the crest of the hill in this case, and is 48 feet above the targets and about 40 feet behind them; the value of this hill background is therefore reduced only by rather less than 3 feet when considered from the 50 yards firing point. A 25 yards firing point, however, situated on the same line, unless it was built up considerably, would have a line of sight rising over 10 feet in 25 yards; consequently a bullet which was aimed left and low would probably ricochet over the left shoulder of the spur.

116. By placing the 25 yards firing point on the extremity of the ridge, as shewn at level 105, a much safer line of fire is obtained, bringing the higher portion of the hill directly behind

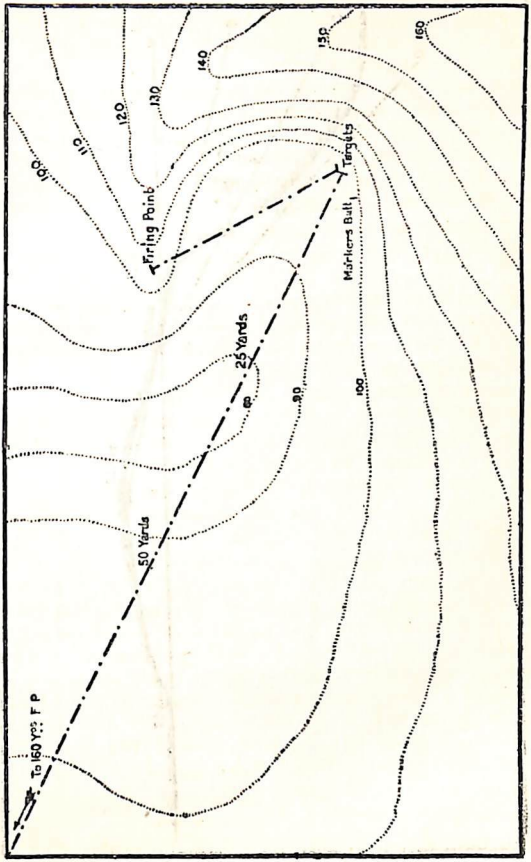
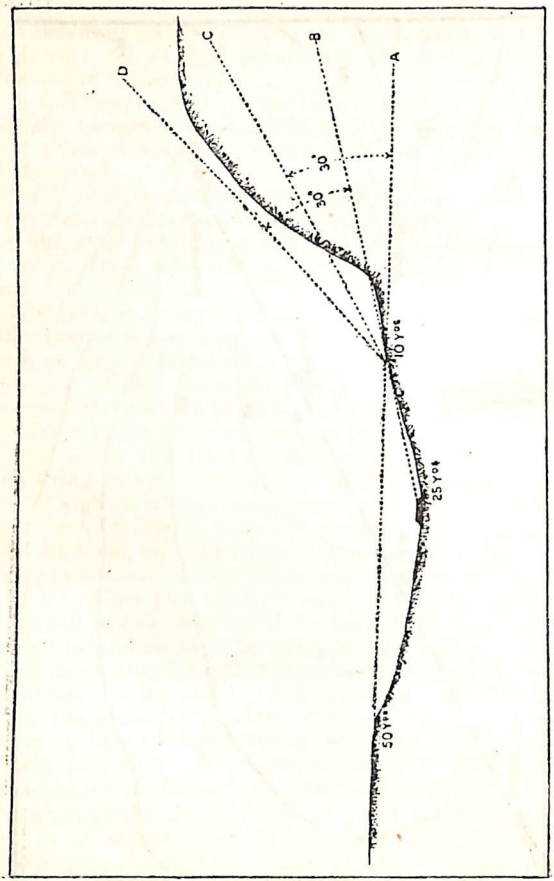

To 160 Yds. F P
50 Yards
25 Yards
Firing Point
Markers Butt
Target
110
120
130
140
150
160
90
100

PLATE 19.



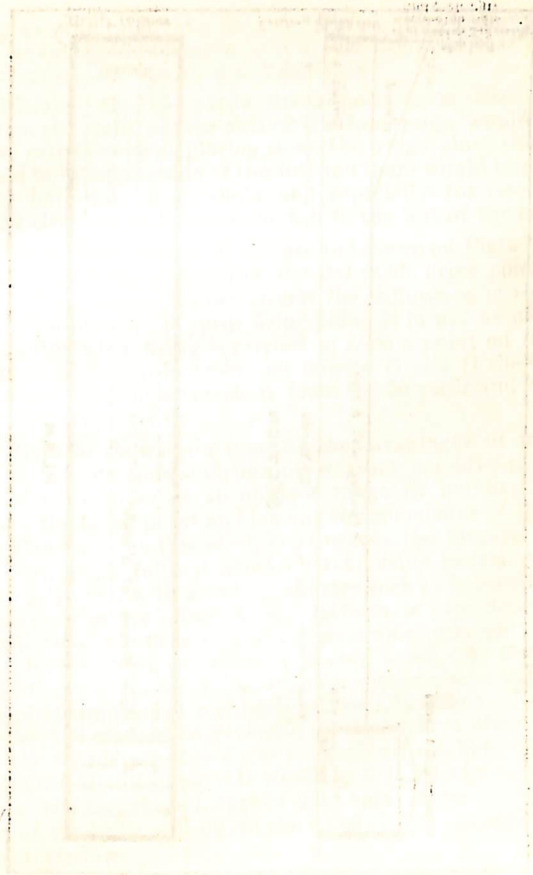
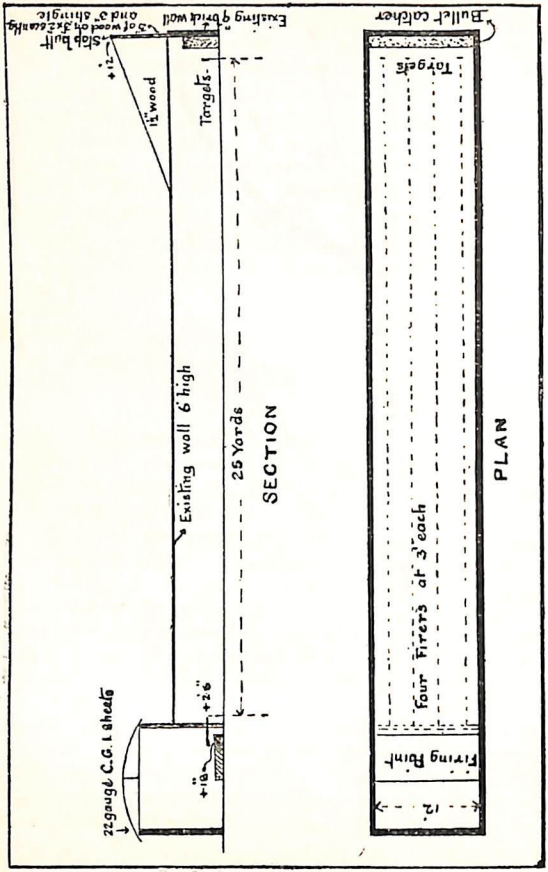


PLATE 20.



Stop butt
3" of wood on 3x2 scantlg and 3" shingle
Existing 9" brick wall
+12"
1½" wood
Targets
Existing wall 6' high
25 Yards
SECTION
22 gauge C.G.I. sheets
+2'6"
+1'8"
Bullet catcher
Targets
Four Firers at 3' each
Firing Point
12'
PLAN

the targets, and with the line of fire slightly down hill. A further advantage obtainable in this case would be that firing at both distances could go on simultaneously.

117. Placing the 25 yards firing point near the 100 foot contour on the right of the axis of the long range would not be nearly so satisfactory as placing it on the ridge, since the line of fire would be along the side of the hill and there would be a greater tendency both for direct shots and especially for ricochets to escape by clearing the spur of the hill to the left of the targets.

118. Plate 19 is a section of the ground shewn on Plate 18 taken along the axis of the range from the 100 yards firing point to the targets. This section shows clearly the difference in the value of the hill when the 50 yards firing point is in use as compared with its value when firing is carried on from a point on the same line but only 25 yards from the targets, C and D shewing the line of flight of possible ricochets from the 50 yards and 25 yards firing points respectively.

119. Plate 20 shews how some of the advantages of an indoor range, as regards independence of weather conditions, may be combined with those of an outdoor range by building a small shed over the firing point and leaving the remainder of the range open. The front of this shed, *i.e.*, towards the targets, is made either with large folding doors or removable panels, or, more conveniently still, with a rolling shutter such as is used for shop windows; a slightly raised firing platform is provided so as to bring the rifle of a firer in a prone position to a height of about 2 feet 6 inches from the general ground level. As the floor of the building will probably be about 6 inches above the ground level, a platform about 1 foot high will usually suffice. Numerous glass windows should be provided in the back or the shed, and also in the side if possible, so as to admit all the light obtainable to the sights of the rifles. It would in fact be advisable in this case to utilise the whole length of both sides of the building from the top of the brick wall up to the height of the eaves in providing extra windows.

120. The end wall over the targets is raised to a height of 12 feet by fixing deal scantlings, at about 4 feet interval, vertically to the wall. Planks are nailed to these and the intervening space filled up with 3 inches or more of fine shingle.

121. Wings should be provided as shewn in Plate 20. As these are only liable to be struck by glancing shots or ricochets, 1½" of timber is sufficient for their construction.

VII.—Instructions for Constructing Indoor Ranges.

122. Indoor ranges, if suitable lighting arrangements are made, can be used for firing at night almost as satisfactorily as by day. On this account an indoor range is invaluable for Territorial units which have difficulty in practising during the daytime. An indoor range can as a rule be constructed in an existing building such as a drill hall, corridor, swimming bath or any large room, or a special building may be erected. 25 yards is the most suitable length and in no case should the length be less than 15 yards.

123. The same degree of safety must be provided for indoor as for outdoor ranges.

Therefore for a 25 yards range, the wall which acts as a stop butt must be rendered bullet proof for a height of 12 feet and for a width 6 feet clear of the flank lines of fire. For a 15 yards range these dimensions may be reduced to 8 feet and 4 feet respectively. This protection as a rule can be more easily provided on an indoor than on an outdoor range. All doors and windows in the stop butt within the dimensions given above must be properly masked. An 1/8th inch steel shutter, which is proof against occasional shots, is the simplest method of protecting such openings. A screen of 3 inches of shingle or granite chippings between boards is also suitable. An ordinary plaster ceiling, a tile or slate roof or a one inch wooden floor may all be considered bullet proof as they

are only liable to be struck by glancing shots or ricochets. All doors and windows in the side walls within an angle of 5 degrees of the line of fire, through which it is possible for a direct shot to escape from the room, must be protected. This will seldom be necessary owing to the thickness of the walls, and when provided need only consist of a one inch wooden shutter. An ordinary one inch solid wooden door in the side walls requires no extra protection.

124. Corrugated iron is by no means proof against ·220 ammunition even in the side walls of a building, as owing to the corrugations it is possible for a bullet to strike the metal almost perpendicularly, and so all corrugated iron within 5 degrees of the line of fire must receive extra protection. One inch planking will be sufficient for the side walls.

125. All metal which is liable to be struck by bullets should be faced with wood to prevent splinters. This applies especially to a steel stop butt, otherwise considerable damage will be done to the floor by splinters. Wooden paving blocks backed by steel plate form a good stop butt, as the blocks can easily be replaced when filled with lead.

126. Travelling targets should generally be used on indoor ranges, thus obviating the necessity for anyone to go in front of the firing point.

127. As much light as possible, preferably from above, should be admitted at the target end. When artificial light is used, the targets should be strongly lighted up by means of a row of lamps with reflectors placed in front of and above the targets and arranged so as to throw the light down. If the lamps are placed below the targets, considerable trouble will be experienced with the mirage or heated air raising from the lamps. This does not apply to electric lights, which can of course be placed below the targets as footlights.

128. For firing at service targets a diffused light is required at the firing point, also, if possible, from above. A strong light on one side should be avoided, as this lights up one side only of the

foresight. For elementary shooting at fixed bullseye targets little or no light is required at the firing point. The intermediate portion of the range requires no illumination. The lamps at the targets must be protected by a steel plate or other means.

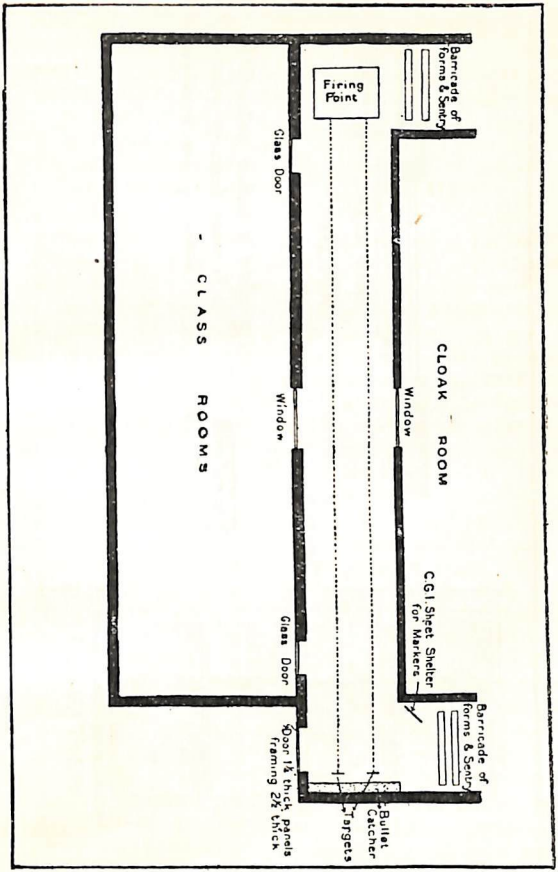
VIII.—Types of Indoor Ranges.

129. Plate 21 is an example of a range fitted up in a corridor of a school. The doors on the right of the range must be locked on the inside while firing is in progress. The window on the right of the range is outside the 5-degree limit and needs no protection; the one on the left is within the limit, and if the cloakroom is used during rifle practice the window must be provided with a 1-inch wooden shutter, or be protected by a 4-inch square post as shown in Plate 22. This quite defilades the window from a shot fired 5 degrees off the target. The edge of such a screen should never come within one foot of the direct line of fire.

130. The door on the right of the range near the targets being 1¼-inch thick and set back in the wall so far that it is impossible to hit it except by richochets or splinters, needs no protection. If the door were flush with the inside face of the wall, and therefore liable to be struck by a direct shot, it would still be bullet proof, as it is 1¼-inch thick in the thinnest part, and only liable to be struck at a very fine angle.

131. The main points of danger on this range are the two passages, one at each end of the corridor. Permanent doors to these would be expensive, and probably objectionable to the school authorities, but it is necessary to place such an obstruction in them as would prevent any boy from rushing straight into the line of fire; the simplest method in this case would be to arrange a barricade of three or four forms or a double row of chairs, &c., with a sentry on the far side of the barricade to warn any one attempting to cross it.

PLATE 21.


Barricade of forms & Sentry
Firing Point
Glass Door
CLASS ROOMS
Window
Glass Door
CLOAK ROOM
Window
C.G.I. Sheet Shelter for Markers
Barricade of forms & Sentry
Bullet Catcher
Targets
Door 1¼ thick panels framing 2¼ thick

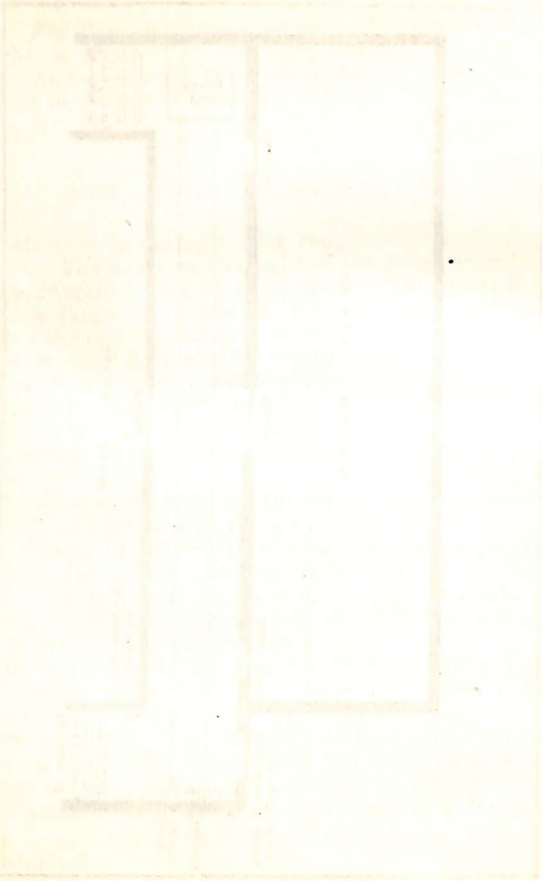
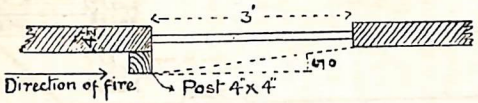


PLATE 22.



PLAN

Alternative method of protecting window of cloak room, if a shutter is not provided

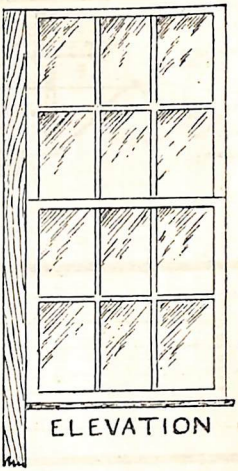
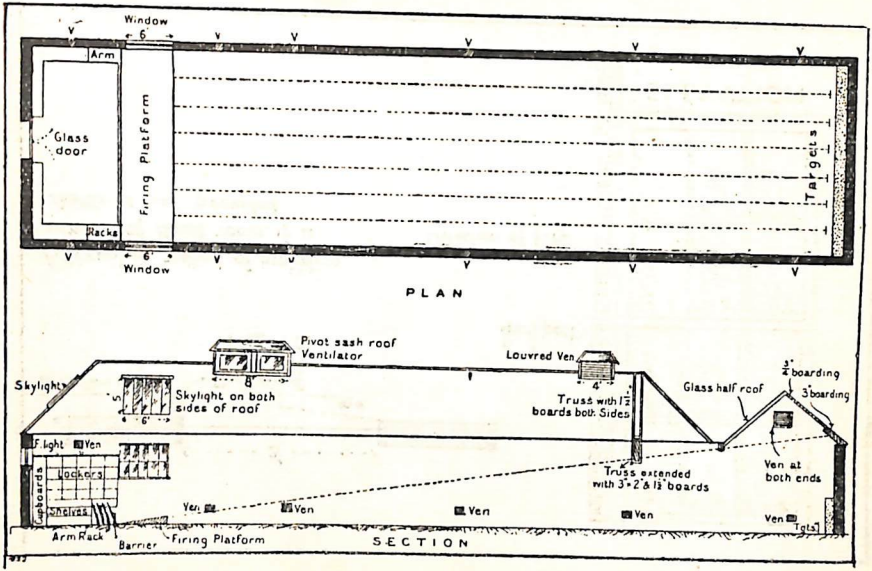


PLATE 23.


Window
6'
Arm
Glass door
Firing Platform
Racks
Targets
Window
PLAN
Pivot sash roof Ventilator
8'
Skylight
Skylight on both sides of roof
6'
Louvred Ven
4'
Truss with 1½ boards both Sides
Glass half roof
2" boarding
3 boarding
F light
Ven
Lockers
Shelves
Arm Rack
Barrier
Firing Platform
Truss extended with 3"×2 & 1½ boards
Ven at both ends
Ven
Ven
Ven
Ven
Tgts
SECTION

132. As regards the marker, on this range he is sheltered from direct shots by the corner of the wall, but if there is any stone, ironwork, or other hard material about near the targets, it will be necessary to protect him from splinters. A sheet of corrugated iron, or a screen of $\frac{3}{4}$ inch boarding, should suffice; it would be an advantage to provide it with a small window of $\frac{1}{4}$-inch plate glass. The marker must, of course, be provided with a red flag, or similar signal, to put up before he comes out of his shelter.

133. The bullet catcher for a corridor range such as this might very well consist of timber alone, some 6 inches thick and of a height and width sufficient to catch the majority of bullets. This object would be obtained by extending it 1 foot above and below the targets and 2 feet clear to the right and left of the outside targets. Further protection to the wall might be given by a 4-inch thickness of wood facing, rising 6 feet from the floor and extending 3 feet clear of the flank targets. This is designed merely to prevent damage to the wall, which, being of 14-inch brickwork, is in itself amply bullet proof. The 6-inch timber bullet catcher may be dispensed with and a sloping steel plate, as in Figure 7, Plate 24, substituted. If the floor is of wood this type of butt causes considerable damage from splinters of bullets and a flat box about 6 inches deep and 3 feet square filled with shingle, and shewn in Figure 6, Plate 24, would be more suitable.

134. Plate 23 is an example of an indoor range in a building intended for use solely for miniature rifle shooting. It will be seen that ample light has been provided for at the firing point end, and also over the targets, but no windows are provided down the sides of the range. It should also be noted that the windows at the sides of the firing point are kept some 6 feet above the ground level. Ventilators are provided along the foot of the side walls, and a large ventilator on the ridge of the roof to carry away all the smoke caused by the firing.

135. Any ordinary roof may be considered bullet proof, since it is only liable to be struck obliquely except at the far end, where it is liable to be hit practically at right angles; this portion of

the roof is, therefore, protected by boarding up the nearest truss with 1½-inch boards on each side, and carrying these boards low enough down to preclude the possibility of the end slopes of the roof being penetrated by bullets.

136. The design of roof at the target end is somewhat expensive, but permits of the light being thrown directly on the targets from the slope of the roof opposite them, which slope may be almost entirely of glass ; it would have been somewhat cheaper to continue the one ridge of the roof all the way down the building, having a gable end over the targets, and to provide two large skylights, one on each side of the roof and each about 8 feet wide by about 5 feet in depth. The end of the skylight nearest the targets should not come within 6 feet of the back wall so as to avoid danger of broken glass from back splash ; and the skylights should, of course, be protected from direct shots by boarding up the truss next them on the firing point side. It is desirable to whitewash, or paint with white paint, the side of the truss towards the targets so that as much light as possible may be reflected on to them.

IX.—DETAILS.

137. For ranges of 25 yards or under it will possibly be most convenient to have the targets mounted on one of the travelling wire systems so that no marker is required. For longer ranges, however, markers' shelters will usually be more convenient. Figure 1, Plate 24, shows a portable iron marker's mantlet for use in an indoor range.

The mantlet shown in the design is constructed of two sheets of ¼-inch sheet iron riveted on to an ordinary angle iron upright of 1-inch by 1-inch by ¼-inch section. The sheets may be of any stock width obtainable, approximately 2 feet.

It is intended to be placed so that the angle iron is towards the firing point ; consequently a bullet either hits the corner of

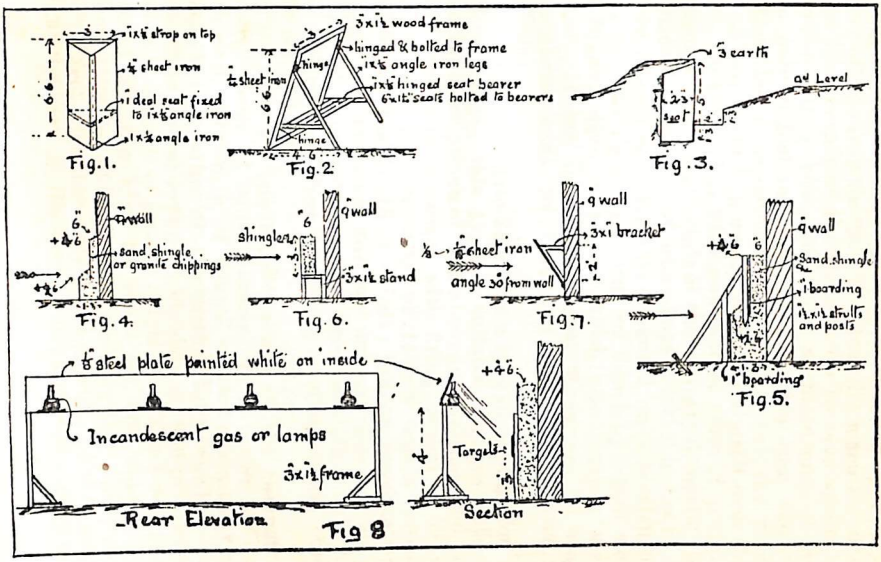


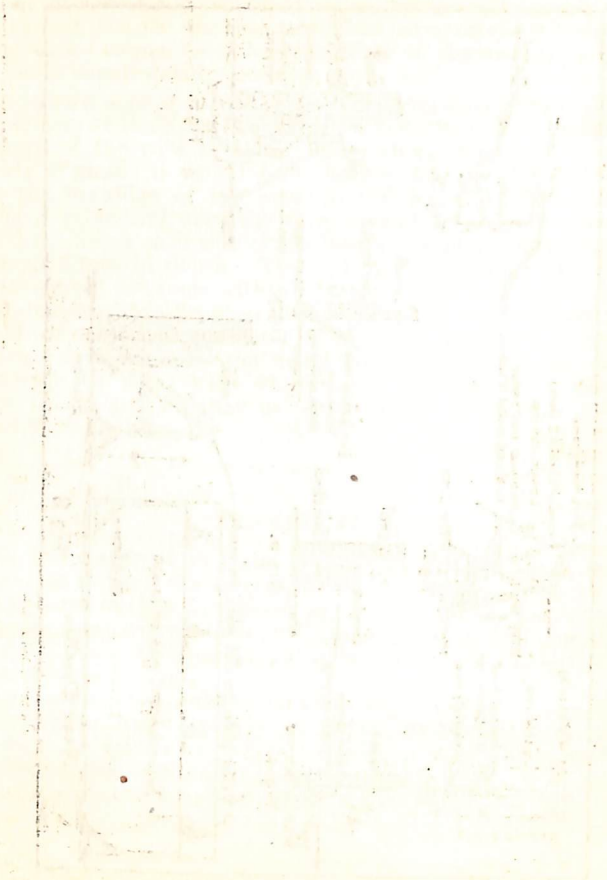
Fig. 1. Fig. 2 Fig. 3.

Fig. 4. Fig. 6. Fig. 7. Fig. 5.

Fig 8

PLATE 24.

G 2



the angle iron, which has ample resisting power, or else it glances off the iron sheets. This mantlet when not in use can be placed in a corner of the room so as to save space. It is best provided with a seat, and when so fitted may, if desired, be made only 5 feet in height, but in this case the top of the mantlet should be covered over to prevent the marker from inadvertently standing up and exposing himself over the top.

138. Figure 2, Plate 24, shews another form of portable shelter constructed on the principle of the ordinary domestic step ladder. It consists of a sheet of iron about 6 feet 6 inches by 3 feet, or nearest stock size obtainable, mounted on a wooden frame, and provided with light angle iron or 3-inch by 2-inch wooden legs and hinged distance pieces, which also carry a seat for the marker. It can be folded up flat when not in use. Special precautions must be taken as regards ricochets off these mantlets.

139. Figure 3, Plate 24, shews a type of shelter for use on an outdoor range; this type is suitable for use with the most powerful descriptions of miniature ammunition, and is specially suited for outdoor ranges with firing points at 50 yards and over. It may be constructed of 1½-inch boards throughout and given an internal width of 4 feet; it then provides comfortable sitting accommodation for two markers side by side. Shelters of this type providing sitting accommodation only are a good deal cheaper than those providing standing room, besides being more convenient.

140. Figure 4, Plate 24, shews one of the cheapest and most effective forms of bullet catcher. It is shewn against a 9-inch brick wall, but it may, of course, be used against any other form of stop butt, whether of the earthen bank, wooden screen, metal plate, or any other type. It consists of two packing cases filled with sand, shingle or granite chippings. The lower packing case is about 2ft. 6in. high by about 1ft. 3in. wide and any convenient length, and is filled to the top; the upper case, which is about 2 feet high, but only 6 inches wide, stands on the top of and at the back of, the lower case, and is also filled. The sand

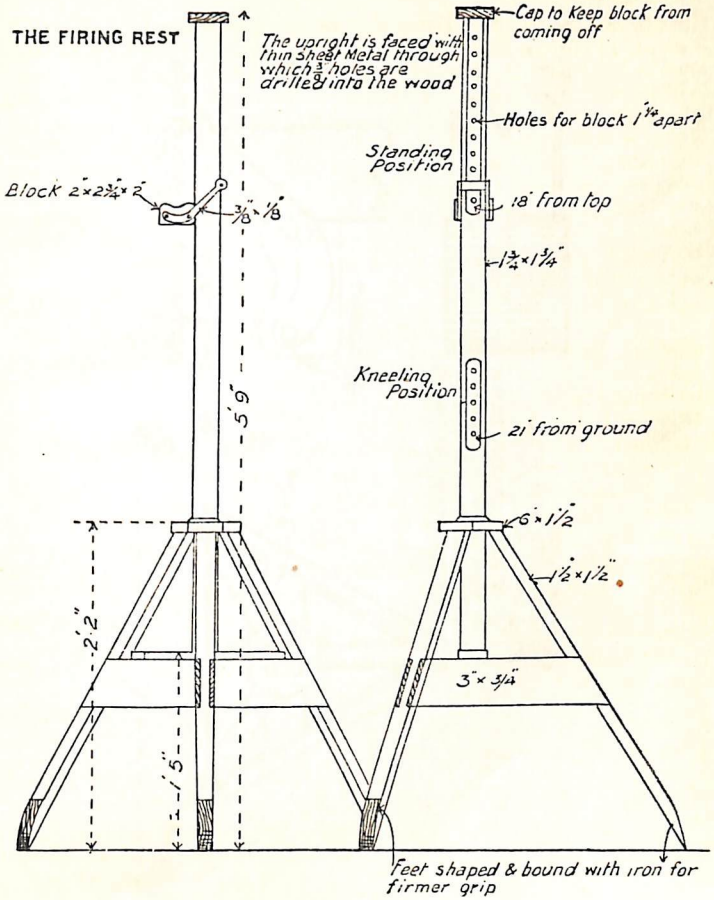
shingle, &c., is piled in front of it on the lower box so as to form a slope, as steep as it will stand. The targets should be placed at such a level that bullets passing through the centre of the target will strike the centre of this slope. The result of this is that the great majority of bullets strike the slope and do no damage at all, while a small proportion hit the bottom of the upper box and the top edge of the lower box. This latter is easily repaired from time to time by the simple expedient of nailing a fresh strip of wood on to the old part; the damage to the upper box is as a rule immaterial, as the material settles down and fills up the holes, but does not run away, as it is held up by the front edge of the lower box.

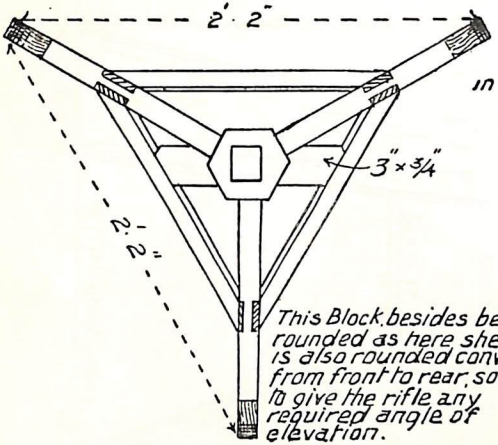
Figure 5, Plate 24, is a design utilising the same idea of the sloping beam of material behind the bulls-eye, but in this design it is held up by boards fixed in position by uprights and struts.

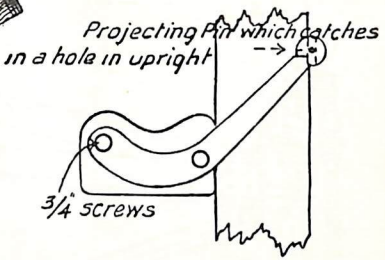
Figure 6, Plate 24, shews an ordinary flat packing case, the lid being firmly nailed on and one of the sides knocked out and filled with dry sand up to the top.

Figure 7, Plate 24, shews how a sheet of iron $\frac{1}{8}$-inch thick may be fixed so as to be proof against repeated hitting, and also so as to throw all bullets down on to the floor. This arrangement prevents windows being broken by the splintered bullets, as frequently happens when a vertical steel butt is used. When this type of bullet catcher is used, it is desirable to protect both the foot of the wall and that part of the floor nearest the wall, say for a width of 15 inches, with iron plate not less than $\frac{1}{16}$ inch thick, as otherwise the continual splinters thrown down by the sloping plate will do a considerable amount of damage.

PLATE 25.


THE FIRING REST
The upright is faced with thin sheet Metal through which 3/8 holes are drilled into the wood
Cap to keep block from coming off
Holes for block 1 1/4 apart
Standing Position
Block 2"×2 3/4"×2"
3/8"×1/8"
18" from top
1 3/4"×1 3/4"
Kneeling Position
21" from ground
5'9"
6"×1 1/2"
1 1/2"×1 1/2"
2'2"
3"×3/4"
1'5"
Feet shaped & bound with iron for firmer grip


2' 2"
2' 2"
3" × 3/4"
This Block, besides being rounded as here shewn, is also rounded convexly from front to rear, so as to give the rifle any required angle of elevation.


Projecting Pin which catches in a hole in upright
3/4" screws

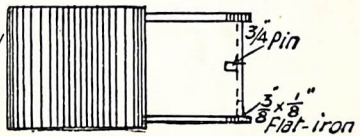
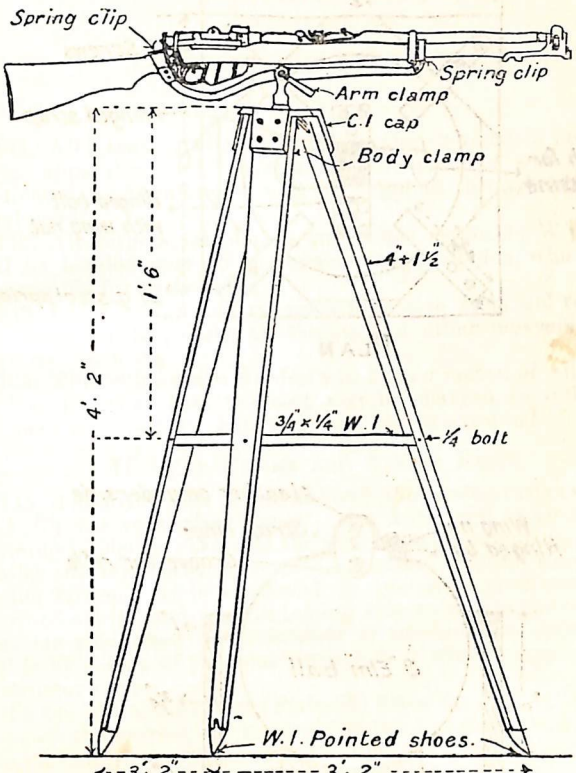
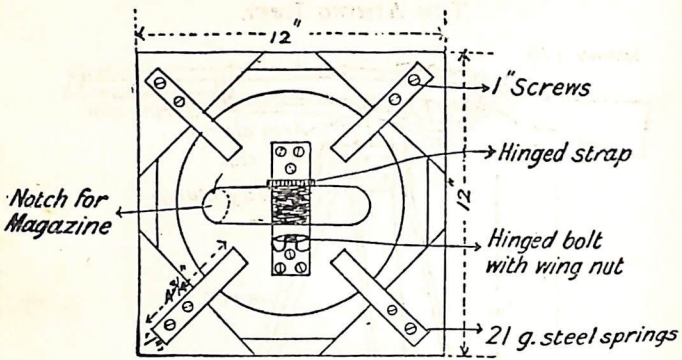

3/4" Pin
3/8 × 1/8" Flat-iron

PLATE 25.

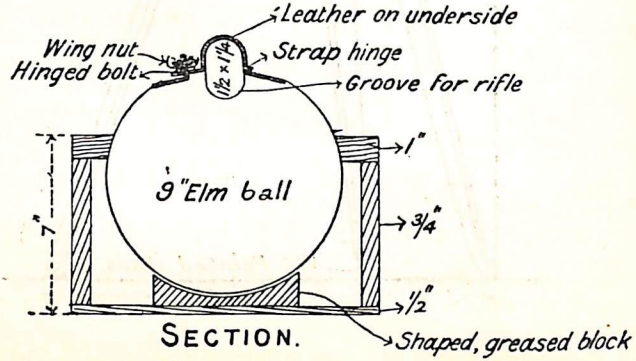
The Aiming Rest.



Ball Rest, Rifle, Aiming.



PLAN.



SECTION.

CHAPTER VI.

TARGETS AND APPLIANCES.

I.—General.

141. All targets (including those for aiming and drill purposes), range apparatus, and range stores, the issue of which is contemplated by regulations, will be supplied through the Royal Engineers.

142. All targets, telephones, and other moveable W.D. stores will be handed over to the senior range warden, who will be responsible for their issue.

143. Units using rifle ranges will receive from and return to the range warden, daily, all targets and other moveable stores required for firing.

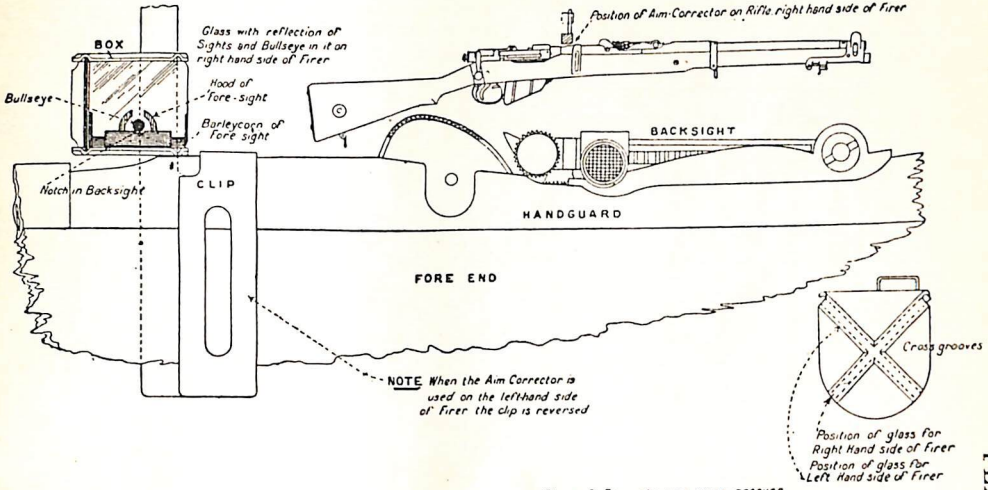
144. The senior range warden will keep a record of all damage or loss, in order that the cost may be charged to individuals or corps responsible. Fair wear and tear is excepted.

II.—The Firing and Aiming Rests.

145. The firing rest (Plate 25) and the aiming rests (Plates 26 and 27) are vocabulary stores. The firing rest is used in early training in firing exercises, the recruit thus supporting his rifle, whilst the instructor corrects his position without causing him undue fatigue. It is employed in the early practices of the recruits' course, and also in testing aim, to enable the recruit to rest his rifle when the instructor is checking the alignment of sights by means of the aim corrector, or when snapping at the instructor's eye.

To use the aiming rest (Plate 26) place the rifle in the spring clips of the moveable arm, screw up the top lever until it causes the moveable arm to be gripped sufficiently tightly to hold the rifle steadily, but not so tightly that the elevation cannot be

THE ARM CORRECTOR.


Position of Aim Corrector on Rifle right hand side of Firer
BOX
Glass with reflection of Sights and Bullseye in it on right hand side of Firer
Hood of Fore-sight
Bullseye
Barleycorn of Fore sight
BACKSIGHT
Notch in Backsight
CLIP
HANDGUARD
FORE END
Cross grooves
NOTE When the Aim Corrector is used on the left-hand side of Firer the clip is reversed
Position of glass for Right Hand side of Firer
Position of glass for Left Hand side of Firer

Plan of Box shewing cross grooves enabling glass to be inserted for use on either side of Firer.

PLATE 28.

easily adjusted from the butt of the rifle without touching the clamping screw. Next screw up the bottom lever hand tight. Aiming practices can then be carried out without further adjustment of the levers.

In the event of the bottom screw lever becoming jammed it may be released by turning the rifle in the direction opposite to that taken by the hands of a clock.

Both screw levers should be slackened when the rest is done with for the day.

The ball aiming rest (Plate 27) is used for instruction in table rest aiming and trigger pressing, and for aiming in the prone position.

III.—Aim Corrector.

146. The aim corrector consists of a small steel box, which is provided with two cross grooves for the insertion of a piece of smoked glass.

The box is attached to, and slides on a stem, and is secured to the rifle by means of a spring clip passing over the handguard.

It may be employed on either side of the rifle. Plate 28 shews the method of adjusting the clip and the glass.

The aim corrector is used for the instruction of recruits, and of bad and indifferent shots, and enables the instructor, who may stand or lie on either side of the firer, to see in the glass the image of the sights and targets at the moment of firing. He can thus, without interfering with the soldier's aim, follow the movements of the rifle and note the alignment of the sights when the trigger is pressed. It must be remembered, however, that if the aim appears in the glass to be to the right of the point aimed at, it is in reality to the left, and *vice versa*.

IV.—Targets for Preliminary Training.

147. A liberal provision of targets for aiming and firing instruction, improvement of eyesight, judging distance, and fire control practices, will be made for the instruction of recruits. They should consist of one or more elementary targets, and numerous figure targets similar to those used for field practices.

148. The full-length figure, when used for aiming instruction, will have a black bullseye on a white ground fixed to the feet as shown in Plate 29.

149. The kneeling and prone field practice figures (Plate 39 and 40) should also be used for practices in aiming, and for development of eyesight.

150. Plates 30 and 31 represent targets suitable for use in aiming and fire control exercises.

Plate 30 shows a simple target consisting of a number of prone figures made of cardboard, and stiffened with light battens, any number of which can be raised and lowered as required by means of strings.

The targent shown on Plate 31 consists of a light pole which is carried breast high by a fatigueman, at its centre. On either side are attached three or more full figures. The upper portions of the figures are made of veneer or wire framework covered with canvas, the lower portion being simply canvas weighted at the bottom and stiffened by light transverse battens.

These targets at a distance of 400 yards and upwards represent very realistically infantry in attack. The fatiguemen with the targets lie down between the rushes, and the prone figures only are then visible.

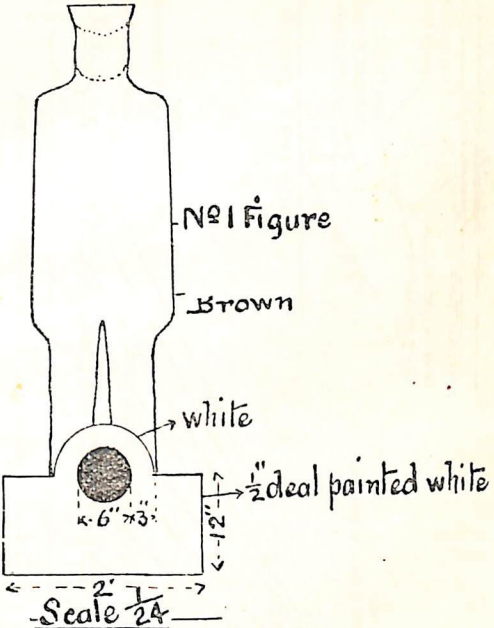
V.—Targets for 30 Yards Ranges.

151. *Elementary Bull's-eye and Figure Targets.*—The elementary bull's-eye and figure targets for use in instructional practices on the 30 yard's range should be similar to those used on the classification range, but reduced to the correct scale, *e.g.*, the target to represent a first class elementary target at 300 yards, should be $\frac{1}{10}$ full size, *i.e.*, 7·2 inches square, inner 4·8 inches diameter, bull 2·4 inches diameter.

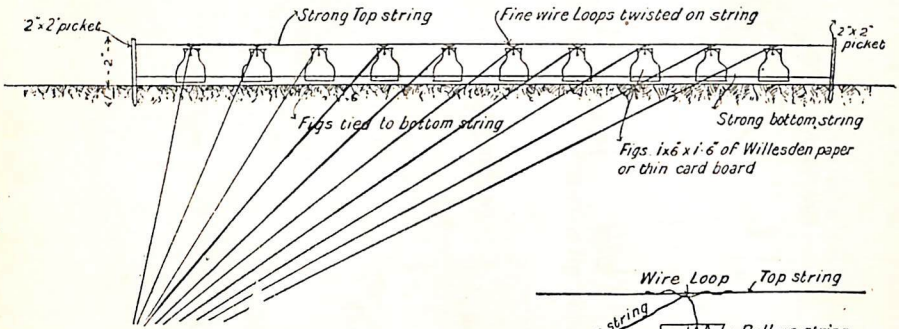
The size of the targets will vary from 14·4 inches square (second class elementary at 100 yards) to 3·6 inches square (first class elementary or figure target at 600 yards).

152. *Long Range Sighting Target.*—(Plate 32.) This consists of a wooden frame made of 3 inches by $\frac{3}{4}$-inch deal battens, clamped

ELEMENTARY AIMING TARGET.



Target for Fire Control Practices (attack).


2"x2" picket
Strong Top string
Fine wire Loops twisted on string
2"x2" picket
2'
Figs tied to bottom string
Strong bottom string
Figs. 1x6 x 1·6" of Willesden paper or thin card board
One Fine string to each Figure to haul up one or more at a time

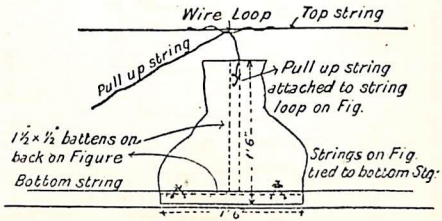
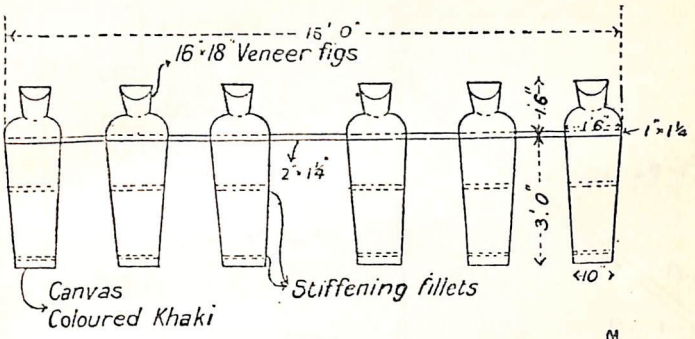
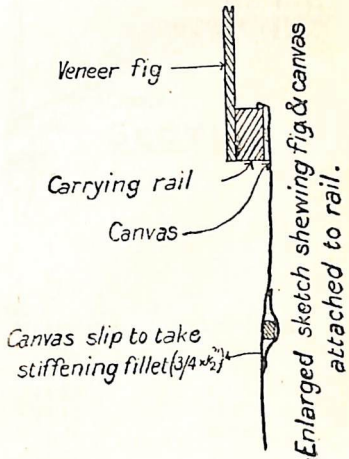


PLATE 30.

TARGET FOR FIRE CONTROL PRACTICES (DEFENCE).

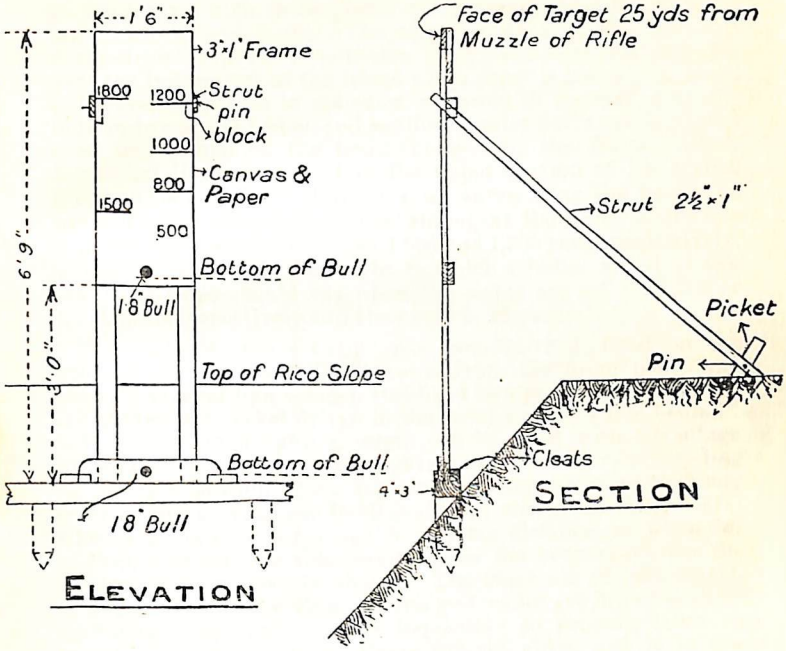


Scale $\frac{1}{60}$


Veneer fig
Carrying rail
Canvas
Canvas slip to take stiffening fillet (3/4"×½")
Enlarged sketch shewing fig & canvas attached to rail.

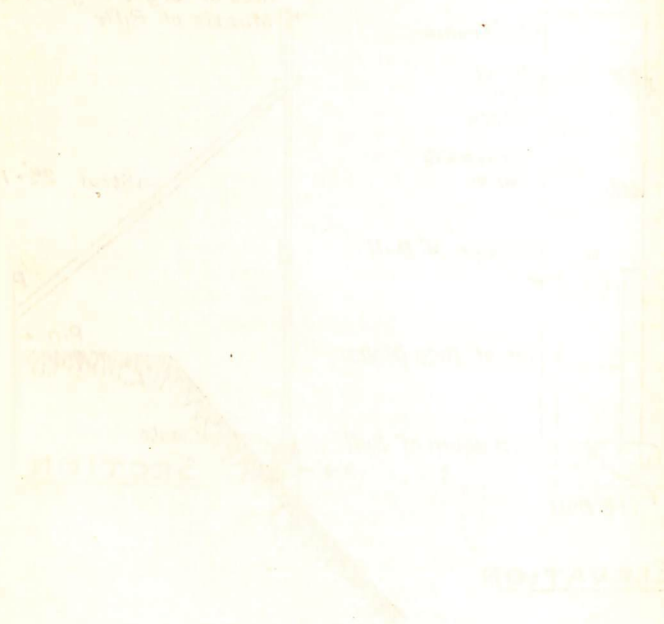
Wire frames covered with canvas & painted, may be used instead of veneer.

The Long Range Sighting Target.



Ordinates.

	S.M.L.E. Mk. III.	Maxim Gun.	22 S.M.L.E.
200 yds.	1·45 in	—	1·17 in.
500 „	6·85 „	5·69 in.	4·27 „
800 „	15·78 „	14·88 „	11·41 „
1000 „	22·35 „	21·17 „	17·98 „
1200 „	31·30 „	28·75 „	26·44 „
1500 „	47·98 „	43·89 „	42·49 „
1800 „	67·94 „	62·60 „	62·08 „
2000 „	84·93 „	—	7s·21 „



at the corners with short pieces of the same material fastened with $1\frac{3}{4}$-inch wire nails. The upper portion of the frame is covered with canvas or Willesden paper, and over this and also over the bottom bar of the frame white paper is pasted. A black bull's-eye, 1·8 inches in diameter, is pasted in the centre of the bottom bar of the frame, and another similar bull's-eye is pasted near the bottom of the upper portion of the frame. Black horizontal lines are pasted on the upper portion of the frame, those on the right side of the frame representing the height to which a bullet should rise when aiming at the upper bull's eye with the sight set for 500, 800, 1,000 and 1,200 yards respectively, and those on the left the height to which a bullet aimed at the lower bull's-eye should rise when the sights are set for 1,500 or 1,800 yards respectively and the range is 25 yards.

The targets are set up on a wooden rail, fixed on the bank of the ricochet pit, 25 yards from the firing point, and are held vertical by a wooden stay fixed to a pin in the side of the target, and to a picket driven in the ground about 4 feet behind.

The long range sighting target can be used with advantage for preliminary testing of the sighting of a rifle before proceeding to the classification range for the ordinary course, so that any errors in the sighting can be allowed for; this is especially useful when the classification range is at some distance, or when for any other reason the time available on the open range for the classification practices is limited. The chief use of this target, however, is to ensure close grouping of collective fire at medium and long ranges; since it is impossible to produce rifles by machinery which will all shoot exactly alike, and it is also impossible to sight all rifles under similar weather conditions at long ranges, the 30 yard's range and long range sighting target afford a convenient means of enabling the firer to learn to what extent his rifle differs from the normal and to adjust it accordingly, with the result that the beaten zones in collective fire can be considerably reduced in depth.

153. *The Snap Shooting Target* consists of a wooden bar mounted on pivots, and worked by a lever pulled by a string from

the firing point ; a counter weight causes the return action ; small cardboard figures are fitted into slots on the bar so as to appear and disappear, as the string is pulled or released.

This target can be used for accustoming the firer to shoot quickly at a comparatively indistinct figure which is only exposed for a limited time ; as the firer becomes more expert, so the time of exposure can be reduced.

154. *The Rapid Fire Falling Targets* are made of stout cardboard in sets of four pivoted on a horizontal wooden bar so that if struck by a bullet they fall over. Two wooden levers worked by strings from the firing point are provided, the one to raise the figures up, and the other to lower them when the time limit has expired, if they have not been struck by a bullet. The cardboard figures and the horizontal bar are provided with staples so that the figures can be easily removed or replaced by pulling out the wire nail which forms the pivot. In attaching the strings to work the levers, it should be noted that the string for the back lever should pass over the front lever and the horizontal bar on which the figures are pivoted ; whereas the other string should pass underneath the front lever, round the small pulley and back to the same lever. (Plate 33.)

When in use the figures should be raised by pulling on the back lever string gently ; as soon as the lever has brought the figures to an upright position the string should be released, when the lever will fall of its own weight. To lower the figures pull the front lever string and release as before. Care should be taken not to keep the strings taut, as the levers then cannot fall and may be damaged by being struck by a bullet. Normally the levers and frames are under cover.

These targets are useful for attaining proficiency in rapid fire combined with changing the point of aim, each firer having four figure targets to hit.

155. *Crossing Target Apparatus.*—This consists of two telegraph wires stretched across the range under cover. Small wooden carriers spaced at 6 feet intervals slide along these wires when pulled by strings from the firing point. Figure targets are provided to fit into these carriers. (Plate 34.)

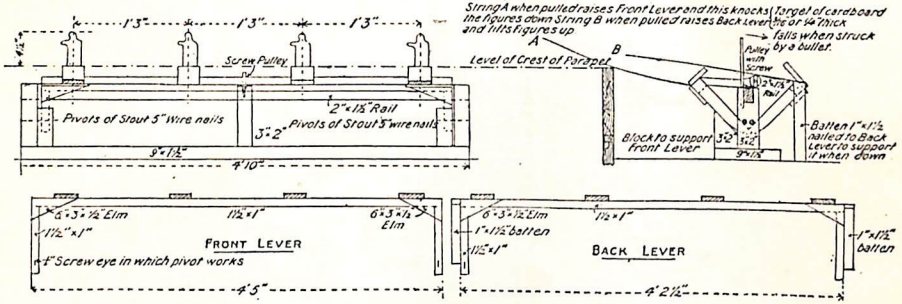
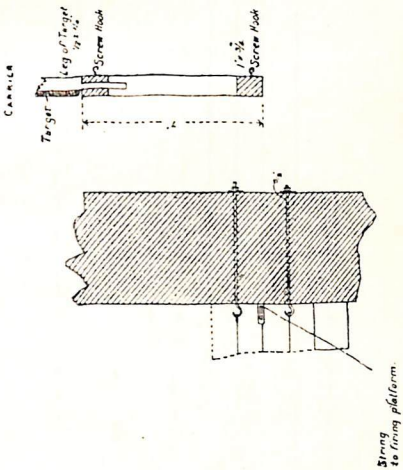

1'3"
1'3"
1'3"
Screw Pulley
Pivots of Stout 5" Wire nails
2"×1½" Rail
3"×2"
Pivots of Stout 5" wire nails
9"×1½"
4'10½"
String A when pulled raises Front Lever and this knocks Target of cardboard the figures down String B when pulled raises Back Lever the or ¼ thick and lifts figures up
A
B
Level of Crest of Parapet
falls when struck by a bullet.
Pulley with Screw
Block to support Front Lever
Batten 1"×1½" nailed to Back Lever to support it when down
6"×3"×½" Elm
1½"×1"
1½"×1"
1" Screw eye in which pivot works
FRONT LEVER
4'5"
6"×3"×½" Elm
1½"×1"
1"×1½" batten
1½"×1"
BACK LEVER
1"×1½" batten
4'2½"

PLATE 38.


Carriage
Target
Leg of Target
Screw Hook
Screw Hook
String
to firing platform

2 24651

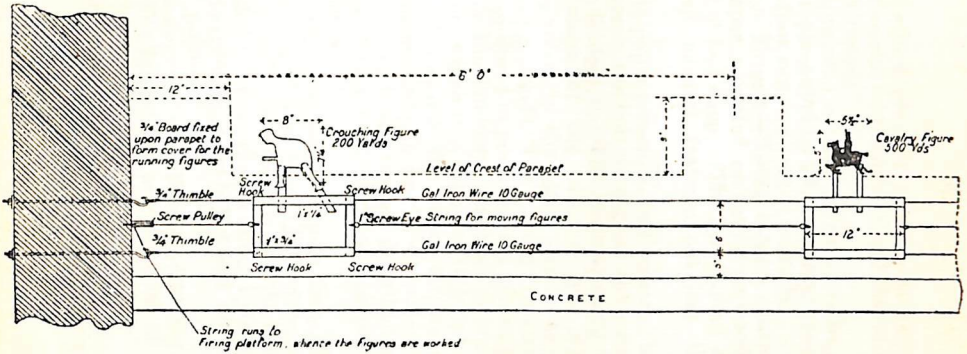
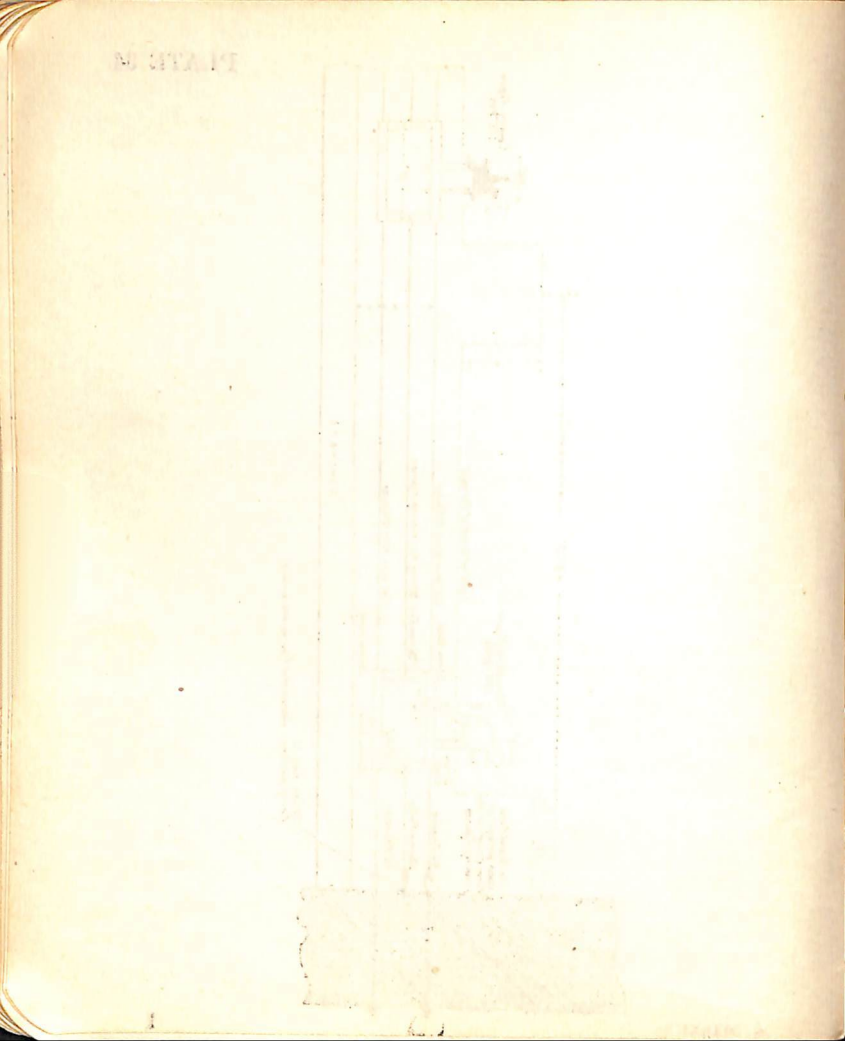


PLATE 34.

I



These targets afford practice in firing at objects crossing the firer's front. The size of the figures and the rate of travel should be correctly calculated.

A crossing horseman at 300 yards travelling at 12 miles an hour would be represented by a figure target about 10 inches high, travelling its 6-foot run in about 3½ seconds.

156. *Landscape Targets.*—These targets consist of printed or painted landscapes mounted on canvas on wooden frames 5 feet long and about 2 feet deep. The foreground of the landscape should represent natural features not less than 1,000 yards distant.

A plain white paper screen, 5 feet square, is placed directly above the landscape, the bottom edge of the screen resting on the top edge of the landscape. The landscape target rests on a ledge on the back slope of the ricochet pit where it is fixed as well as the screen, in the same manner as described for the long range sighting targets. The leading features of the landscape can be roughly outlined in pencil on the screen at a height above their position in the landscape reckoned in accordance with the sighting elevation, which it is intended to adopt.

157. Suitable landscapes for these targets are produced in poster form, dimensions 60 inches by 40 inches.

When they are used in the manner described above, the top and bottom portions should be folded back to produce a picture 60 inches by 24 inches.

158. When firing at landscape targets the sighting elevation on the rifle should be not less than 1,000 yards, so that all bullets may strike the screen without damaging the landscape itself.

If it is intended to fire at ranges under 1,000 yards, the pictures must be made narrower, as the bullet will not rise sufficiently to clear the 2 feet picture.

If there is no financial objection to renewing the targets from time to time, the landscapes may be fired at directly with no sighting elevation on the rifle.

These targets may be used to practise the rapid indication and recognition of objectives, rapid and accurate adjustment of sights,

use of long range and dial sights, collective fire, choice of targets for individual fire, and use of field glasses.

159. *Skirmishing Targets.*—These targets consist of a series of targets of various figures, full length, kneeling, prone, cavalry, machine guns, &c., correctly scaled and with the outline of the figures drawn above as described for the landscape targets.

The targets are mounted on a long strip of canvas on two rollers, so arranged that the figures can be shown in quick succession, one target only appearing at a time.

Suitable targets may be made representing infantry advancing from 600 to 200 yards, a full length, a kneeling, and a prone figure being shown at each 100 yards.

These targets afford practice in judging distance by the visual angle, rapid adjustment of sights and choice of target for individual fire. The target is controlled from the firing point and each figure may be exposed for any desired period of time.

VI.—Machine Gun Targets.

160. For the machine gun, the 30 yards' range offers great facilities; there is a very great deal of purely mechanical work in the handling of a machine gun for which it is quite unnecessary to go to an open area; the 30 yards' range targets offer a quicker and more certain method by which faults may be detected and corrected.

161. *Long Range Sighting Target.*—A target similar to that used for adjusting the rifle sights may also be used for adjusting the sights of the machine gun, or for obtaining a definite knowledge of its error from the normal, an error which can then be allowed for. It must be borne in mind, however, that if the machine gun is placed nearer to or further from the target than 25 yards the heights of the lines above the bull's eye aimed at must be adjusted accordingly It must also be remembered that single shots or groups of two or three shots must on no account be used for this purpose, since nearly all machine guns shoot differently when

firing single rounds or very small groups or when firing larger groups. Groups of at least five rounds should be fired.

Landscape Targets.—These targets may be used firstly, for single guns, to accustom the firers to laying on an indistinct mark such as a feature of ground; for practice in quickly altering the sights and ranging correctly; for traversing fire, either lateral or vertical; or a combination of both. Secondly, they may be used for practice in the collective fire of two or four machine guns, either in lateral or in vertical distribution of fire, or in any combination of fire such as might be required for sweeping a hidden area of ground said to be occupied.

Thirdly, these targets may be used for indirect fire, when not only the position aimed at should be indicated on the upper target, in order that the correct elevation for that position may be found, but also a rectangle should be drawn above it to represent the unseen area of ground which it is intended to sweep. For instance, a battalion in quarter column is said to be hidden in a fold in the ground; the crest in front of them is used as an aiming mark, and is estimated to be about 200 yards in front of the objective. The diagram target indicates this crest at such a height above the crest in the landscape aimed at as will represent, say, a range of 1,600 yards. The proper position then for the centre of the cone of fire for 1,800 yards will be about 16 inches above the crest line in the diagram, and allowing for an error of 50 yards in range, and of 20 yards laterally in locating the objective, it will be desired to sweep the area extending over a total width of 40 yards, and total depth of 100 yards. This will be represented on the target by a rectangle some 8 inches high by 2 feet wide, the bottom edge of the rectangle being roughly 12 inches above the mark indicating the aiming point.

162. *Instructional Target.*—This target is of similar construction to a classification range target measuring 8 feet by 4 feet, with legs 2 feet long. The target is faced with white paper. It is intended for use on a 30 yards range or against the stop butt or earth bank of marker's gallery of a classification range. The

target in each case must be placed 25 yards from the muzzle of the gun.

The target provides instruction in :—

(a) Horizontal traversing.
(b) Diagonal traversing.
(c) Vertical searching.

The aiming points consist of brown full-length figures, 3 inches high and 4 inches apart centre to centre, placed on a green and grey background.

For (a) and (c) the bottom of the figures are 6 inches above the bottom of the target.

A band 3 inches wide, 20 inches long for (a) and 30 inches long for (c) is indicated by means of two black lines $\frac{1}{4}$ of an inch wide, the centre of the band being 15 inches above the feet of the figures For (c) a third black line, $\frac{1}{4}$ of an inch wide is placed 35 inches above the feet of the figures.

For (b) three lines of figures and 3 bands as in (a) but each of a horizontal width of 10 inches, will be joined together, each making an angle of 120 degrees with the next.

The bands are divided into rectangles, 2 inches wide, by vertical lines invisible at the firing point, drawn from the top to the bottom of the target.

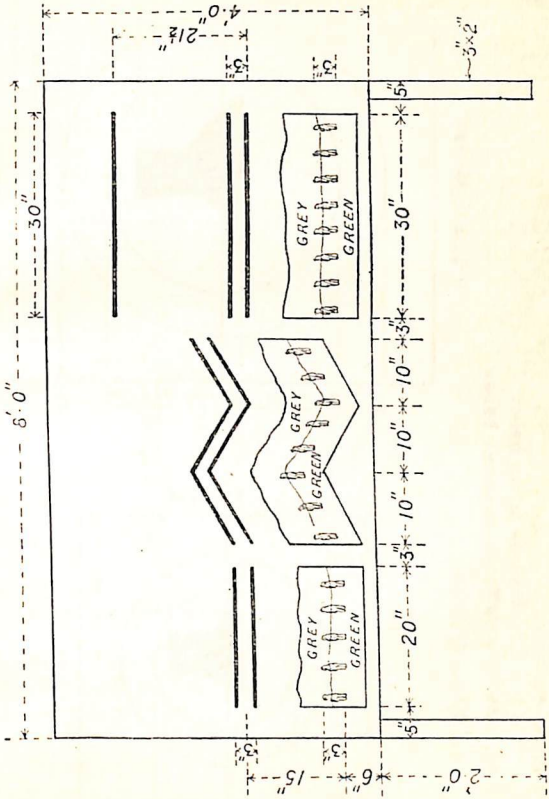
When the target is used against a light background, brown bands may be used to enable the bullet holes to be seen more easily from the firing point.

VII.—Targets for Classification Ranges.

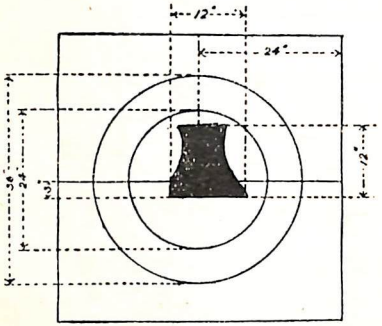
163. Elementary targets are of two classes :—

	1st Class.	2nd Class.
Size of targets	6 by 6 feet	4 by 4 feet.
Diameter of bullseye	2 feet	8-inch black disc and 12-inch invisible scoring ring.
Inner	4 feet	2 feet.
Outer	Remainder of target.	

Instructional Target.

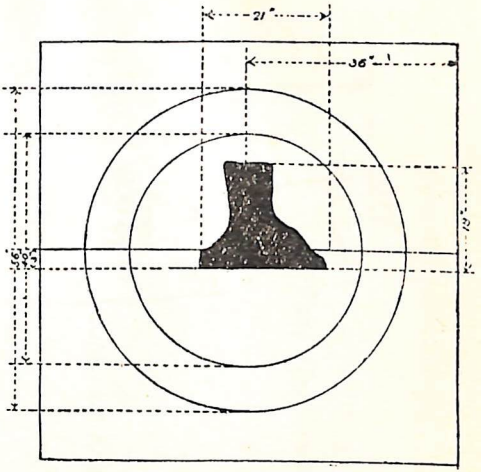


SECOND CLASS FIGURE TARGET.



4 FEET SQUARE.

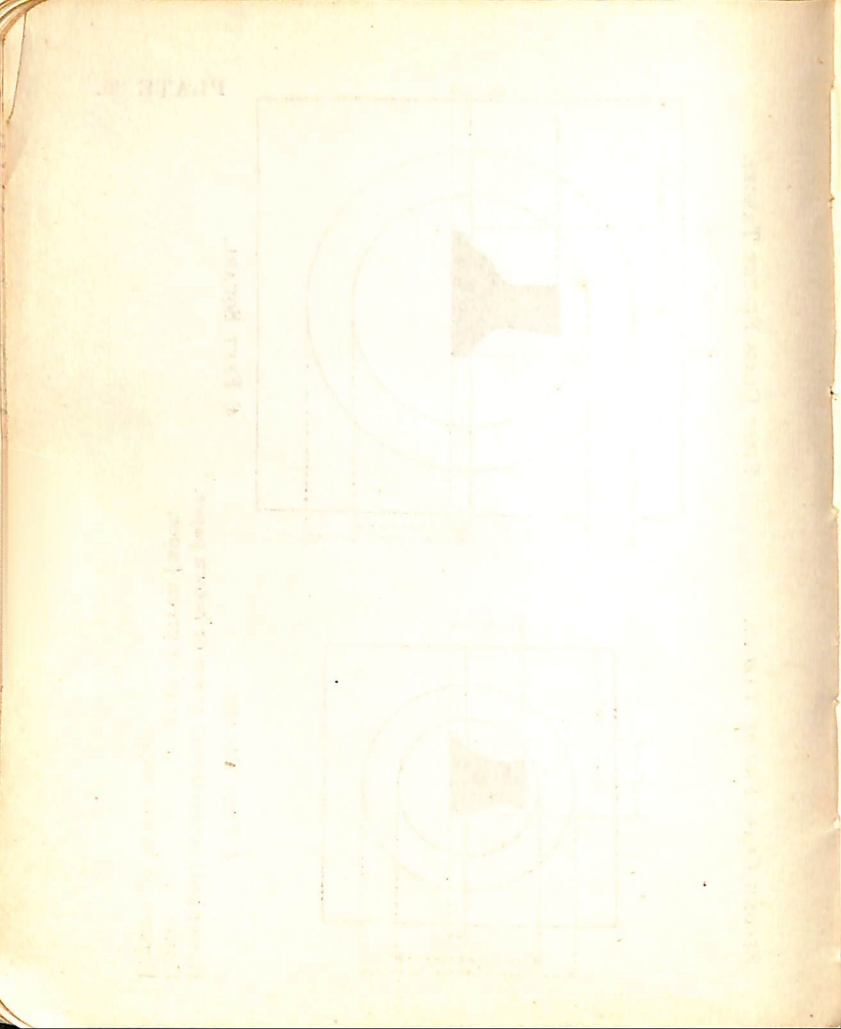
FIRST CLASS FIGURE TARGET.



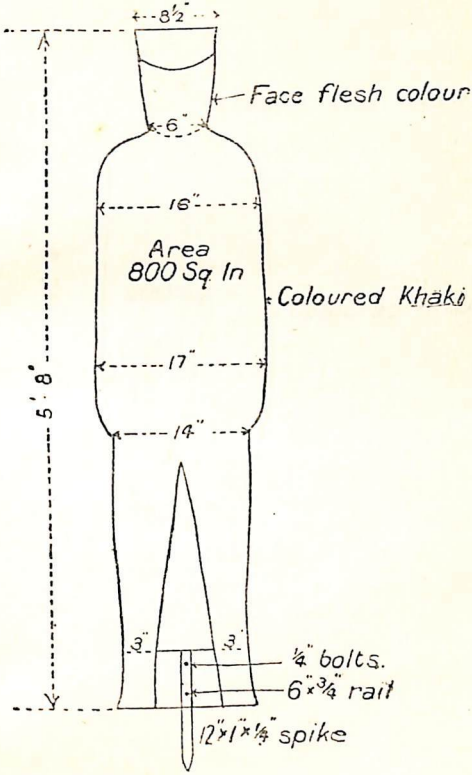
6 FEET SQUARE.

Lower half covered with green or brown paper.
Upper ,, ,, ,, gray or green paper.
Figures of brown paper.

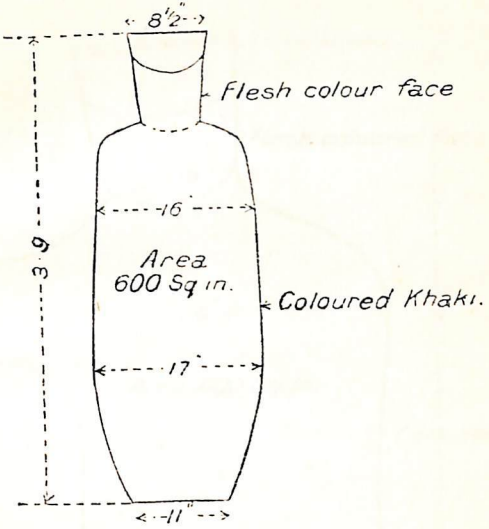
PLATE 36.



FULL FIGURE (No. 1).

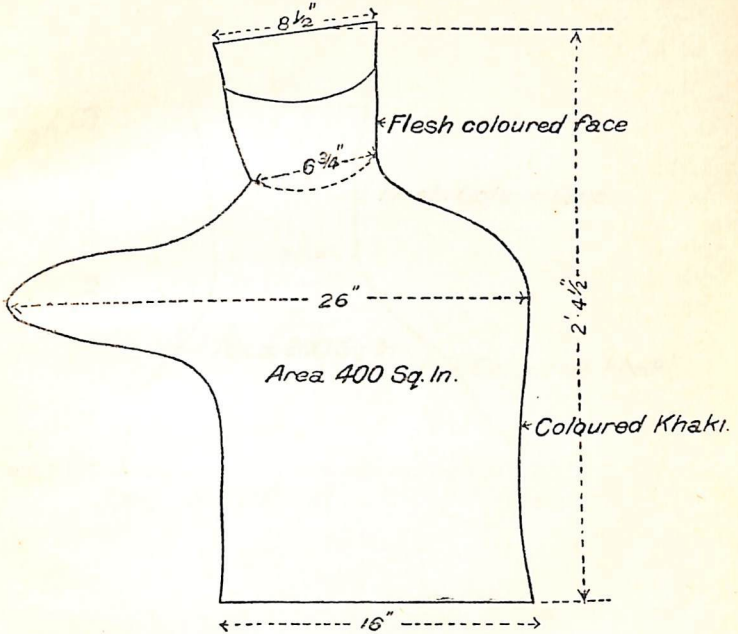


¾ FIGURE (No. 2).



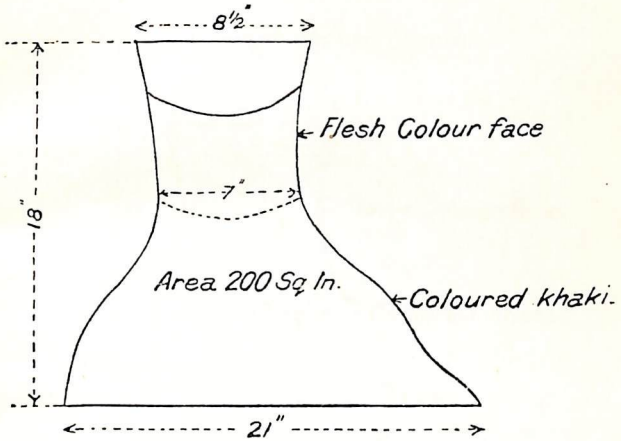
Scale $\frac{1}{20}$

KNEELING FIGURE (No. 3).



Scale $\frac{1}{10}$.

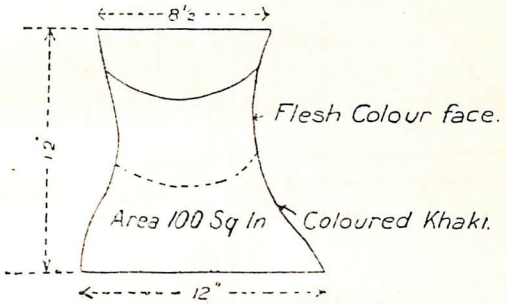
PRONE FIGURE (No. 4).



Scale $\frac{1}{10}$.

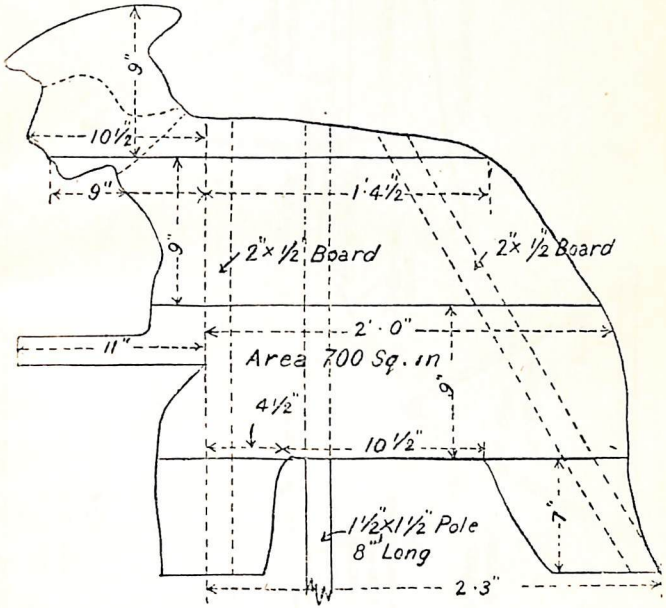
PLATE 41.

COVERED FIGURE (No. 5).

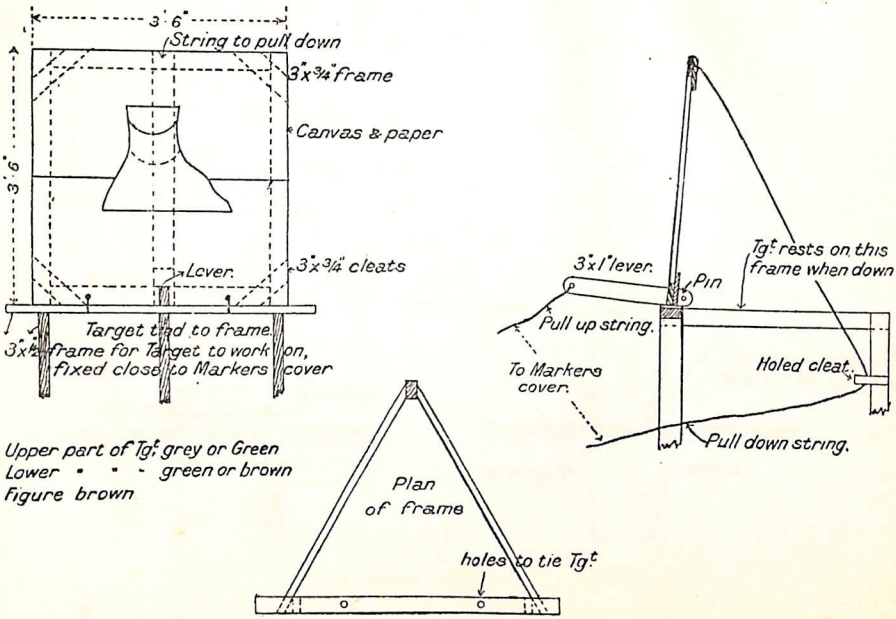


Scale $\frac{1}{10}$.

CROSSING FIGURE (No. 6).



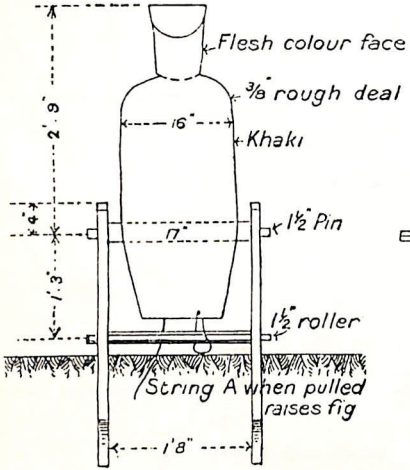
Disappearing Elementary Figure Target.



Upper part of Tg.t grey or Green
Lower " " - green or brown
Figure brown

PLATE 43.

Disappearing $\frac{3}{4}$ Figure (No. 2).



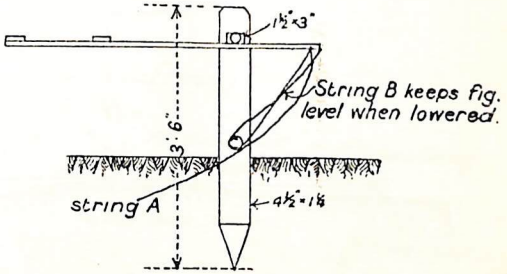
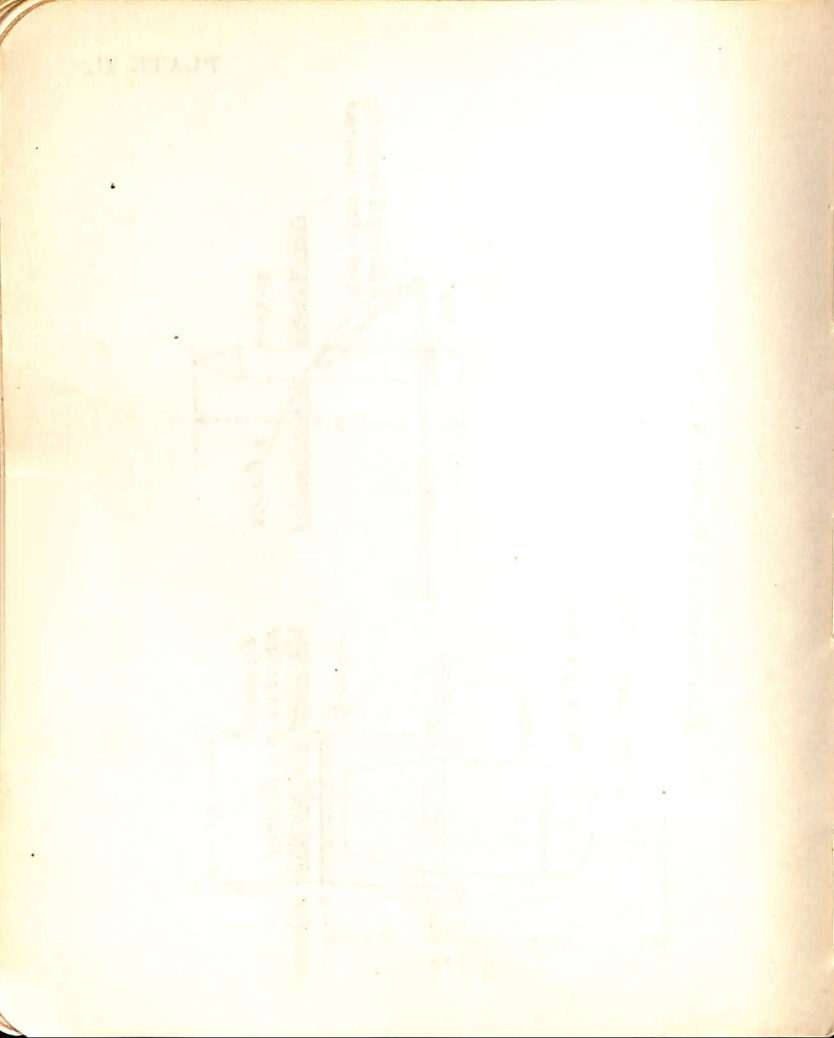


PLATE 44.



Disappearing Figure (No. 3).

Kneeling.

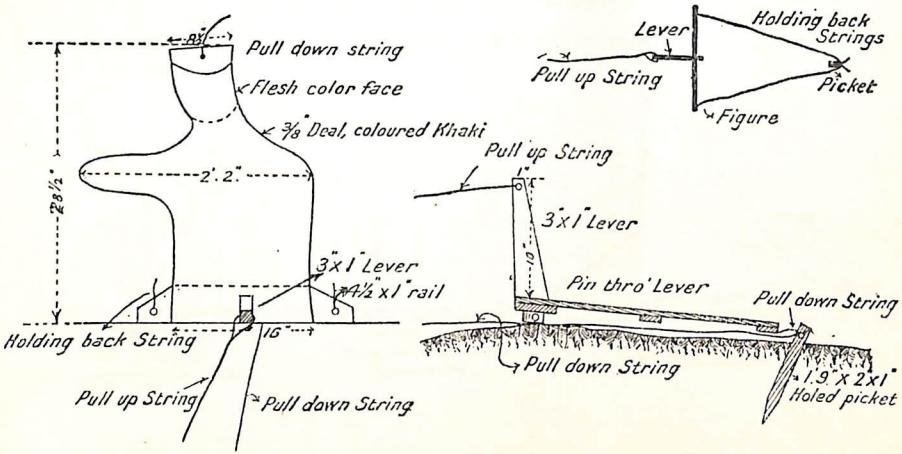


PLATE 45.

Alternative Disappearing Figures.

Prone Fig. or ¾ Fig. can be shewn at will to represent an Inf. attack.

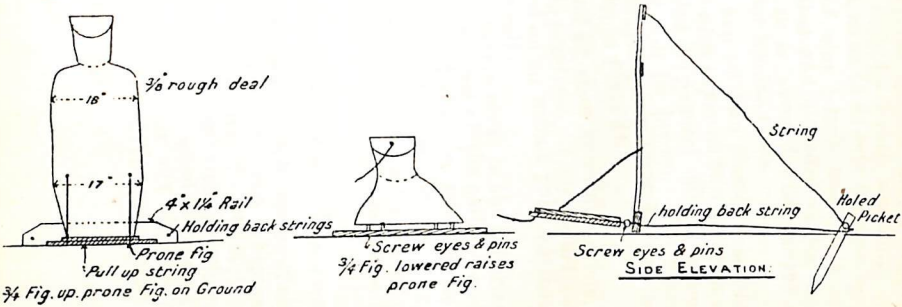


PLATE 46.

For use with the Hythe pattern target frames, the targets should be made of 3 inch by 2-inch scantling, with the sides extended 2 feet 6 inch, so as to fit into the iron carriers.

Triangular pieces of elm $\frac{1}{2}$-inch thick, cut out of 11-inch planks, should be nailed and clenched at the four corners to stiffen the frame, which is covered with canvas stretched and fastened with $\frac{3}{4}$-inch flat-headed tacks.

164. Figure targets are of two classes (*see* Plate 36). The targets will be covered with paper of two different colours, green, brown or grey as decided by general officers commanding. The figure placed centrally will be brown. The figure on the 1st Class target will be that shewn in Plate 40, and that on the 2nd Class target, that shewn in Plate 41.

165. Plates 39, 40, and 42, shew kneeling, prone, and crossing figures for snapshooting practices. They should be made out of $\frac{3}{8}$" boards, and mounted on an 8-foot pole, so that they can be easily shown above the gallery.

On old ranges with concrete roofs to the galleries, half a brick may be cut from the inner crest of the gallery, and a light rail placed there. Hooks should then be attached to the poles of the crossing figures, which engage on the rail, and are of great assistance in windy situations in working these targets. They also ensure that the same amount of the target is exposed every time.

VIII.—Targets for Field Practices.

166. To obtain the best instruction by means of elementary field practices each individual should be given a separate target and should be informed of the results of each shot which he fires. Disappearing targets should be used almost exclusively.

These conditions can best be satisfied by means of penetrable targets (*see* Plates 43, 44, 45 and 46), worked by markers in shelters, and set up at a distance between 5 and 10 yards in front of them.

167. Plate 43 shews a brown prone figure, on a coloured background measuring 3′ 6″ by 3′ 6″, for use in Nos. 1 and 2 Individual Field Practices.

A hit on the figure is indicated by lowering and then raising the target by means of a cord. Hits on other parts of the target are shewn by the marker by means of a small disc on a light pole. The target is made of 3″ x ¾″ deal battens, clamped at the corners with pieces of the same material, covered with canvas and paper in the same way as the instructional figure targets. Two strings should be used to ensure steady working in a wind, *i.e.*, one to pull the target up and another to lower it.

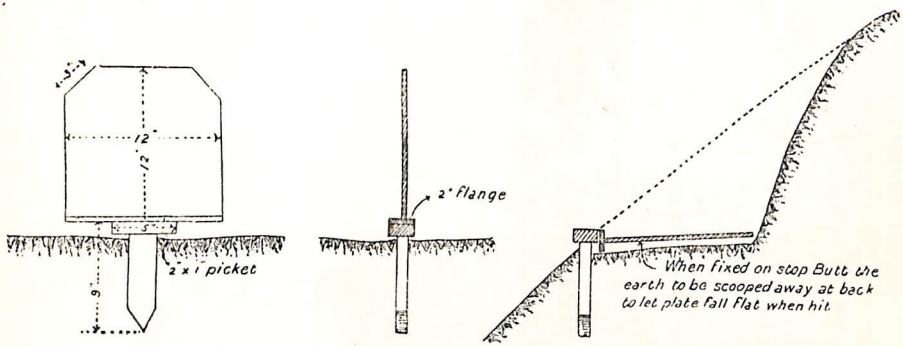
For this target it is advisable to construct a light framework in front of the marker's pit.

168. Three-quarter figures (Plate 38) mounted as shewn in Plate 44, kneeling figures mounted as in Plate 44 or fitted with levers as in Plate 45, prone figures similarly fitted with levers, and alternative figures (Plate 46), are suitable for more advanced field practices, and can be used to represent an enemy appearing from behind cover, advancing or retreating. The method employed in the latter case is to set up lines of the three-quarter figures at different distances. To represent an advancing enemy, the line furthest from the firers is raised, either simultaneously or man by man, for the time that would be taken to advance to the next position; after an interval the procedure is then repeated with the next line and so on. For a retreating enemy, the action is reversed.

169. Figures mounted as in Plate 44 should not be fired upon at distances less than 400 yards. They may be operated in dry weather from a distance as great as 300 yards from the pit. When several lines are used to represent an enemy appearing from behind cover, unless they are placed in echelon, the legs of those at short ranges obscure partially the view of those at longer distances.

170. The number and arrangement of targets will exercise a very great influence on the value of collective field practices.

Falling Steel Target for Field Practices.

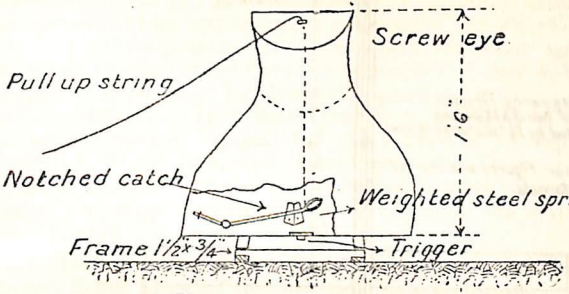


This Target can be either of $\frac{3}{8}$'' mild steel weight 18 lbs., or of $\frac{1}{4}$'' hard steel weight 12 lbs.

(This $\frac{1}{4}$'' should not be used for distances less than 200 yards.)

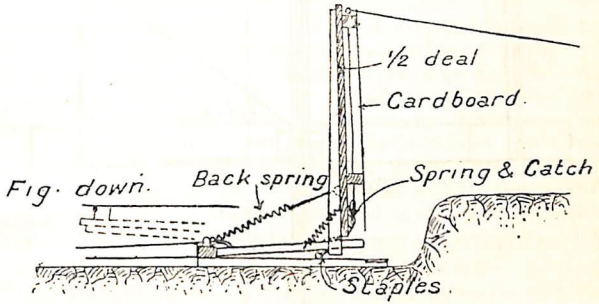
PLATE 47.

Falling Target.



FRONT ELEVATION.

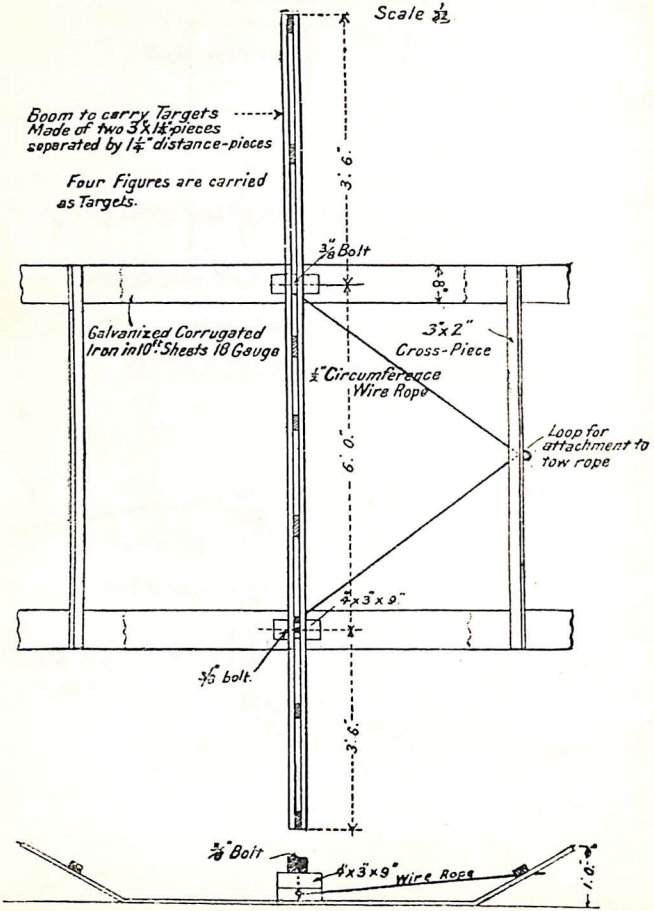
CARDBOARD CUT AWAY TO SHEW SPRING



Side Elevation.

Scale $\frac{1}{16}$.

Sledge to Carry Advancing-Infantry Targets.



Generally speaking, the frontage of the target formation or position should be approximately equal to the frontage of the firers; in attack practices the target may represent the heads of defending troops behind cover or appearing at intervals above a parapet; there may be loopholes, bushes, machine guns, or similar objectives. In defence practices they should consist of full-length figures, exposed for short periods, to represent an advancing firing line, and heads and shoulders or kneeling figures to represent the same line halted in a fire position or long grass. The target shown in Plate 46 combines the standing and prone figures.

171. The number of the figures should bear relation to the scheme, firing lines in defence practices containing about one figure per yard at distances below 1,000 yards, and having intervals of about two paces between figures at longer ranges. In attack practices the figure targets representing defenders may be fewer in number than the firers. The targets should generally represent a squad, section, or other recognized unit.

172. Moving targets can be constructed by mounting figures on sledge runners or rails.

Plate 49 shews a form of sledge, to carry targets representing bodies of men in motion. It is made of two strips of corrugated iron, each 10 feet long, bent up at the ends so as to ride over any unevenness of the ground, and joined together with light deal scantlings, which also serve as sockets to carry the targets. It is drawn by means of $\frac{1}{2}$-inch flexible wire rope by a horse or by six men working a winding drum; 400 yards is a convenient length of run, and over rough or undulating ground gives a realistic effect. Hauling apparatus is, however, unsatisfactory except for crossing targets, and in war targets are seldom exposed to view for more than a few seconds at a time; advance and retirement are therefore better simulated by regulating the exposure of full length and prone figures, according to the time occupied in making a short rush forward, or a retirement, and the intervals of time between such movements. Unless targets

electrically operated are available, it is, therefore, necessary to provide a number of markers' pits if the effect of a continuous advance or retirement is to be produced, and from these pits a considerable number of disappearing targets may be controlled by a few men.

173. Collapsible targets are of steel (Plate 47), earthenware, or light material held in position by a latch or similar contrivance till struck by a bullet (Plate 48).

They are of great value for teaching the observation of fire, timing the first effective shot, comparative tests of volume and accuracy, and in many other forms of training. They also add interest to field practices.

Their use can be much extended if they are mounted as disappearing as well as collapsible targets (Plate 48).

174. The practice of requiring units to arrange targets or positions for others to fire at, or during a skirmish to place head and shoulder targets on the ground to represent themselves in position at any temporary halt has been found to stimulate interest.

175. Falling or collapsible targets are of great value in all field practices and may be used with advantage in casualty competitions designed to test the relative abilities of two firing lines, which simultaneously fire at separate sets of targets representing their opponents. Each man is represented by a target placed in front of the opposing firing line and becomes a casualty if that target falls.

In this way superiority of fire is soon established by one line or the other, and fire ceases.

The mounting of collapsible targets on shafts to enable them to be operated also as disappearing targets requires much care, so that any jar which may cause the targets to collapse prematurely may be avoided.

176. If steel falling targets are used they should be sited in anticipation of danger from ricochets. They should not be placed on or near the firing points of an ordinary classification range,

especially when other ranges are in proximity on either side. They may, as a rule, be placed on the face of a stop butt, but never on the roof of a gallery, and not in ordinary circumstances on the crest of a stop butt.

177. Steel falling targets will always be provided with small wooden rests, so constructed that the targets must fall when hit. An iron target may otherwise turn when hit without falling, and cause dangerous ricochets.

178. The visibility of targets in collective field practices must not be exaggerated; it is the void of the battlefield which causes the greatest difficulties in fire direction. In standard tests of fire effect or vulnerability it is generally desirable, for purposes of record and future comparison, to provide most favourable conditions of weather, light, visibility, known range and ample arrangement, but in tests of fire direction, control, and discipline, service conditions are indispensable. With or without firing, study of the visibility of fire positions, head cover, machine guns, &c., should form a most important part of training by means of field practices.

For this reason defensive positions should, as a rule, be prepared by one unit, as an exercise in screening defences, for another unit to attack. If the targets are invisible there will be the more reason for advancing under covering fire to a position whence the targets can be made out, and fire opened in conditions more favourable to fire effect.

179. Provided that full details as to the conduct and arrangement of collective field practice are available, the results afford much useful information for comparative purposes and lectures.

The superficial area, therefore, of the targets should be recorded, and company officers should always be in possession of a descriptive list, showing the number and nature of targets available for their use, with their superficial area.

180. It is often desirable to use additional targets or screens in order to obtain adequate information as to the position of the

nucleus of the fire cone with reference to the point of aim; in this case the additional targets may be regarded as bullet catchers and should not be exposed to view ; the number of hits obtained on them would be recorded apart from those on the tactical objective.

Ricochets should also be recorded separately, as their number varies according to conditions of ground.

181. In deep formations it will be necessary to space lines of targets from each other according to the angle of descent of the bullets, so that direct double hits may be avoided.

182. Rectangular canvas screens should be provided on all field practice ranges.

Screens for collective grouping tests, fire direction practices, &c., should be made of canvas stretched on battens. They should be one yard high and made in lengths of 10 feet. There should be sufficient screens to form three rows, each 40 feet in length.

183. Figure targets are, as a rule, made of wood or cardboard ; figure-shaped tiles, made at small cost for competitions, pool shooting, &c., are safe and useful collapsible targets ; numerous patterns of collapsible targets depending on the action of springs and catches are available, and disappearing targets, operated by electricity, are very useful on ranges insufficiently provided with markers' pits, as a means of meeting difficulties when markers are scarce.

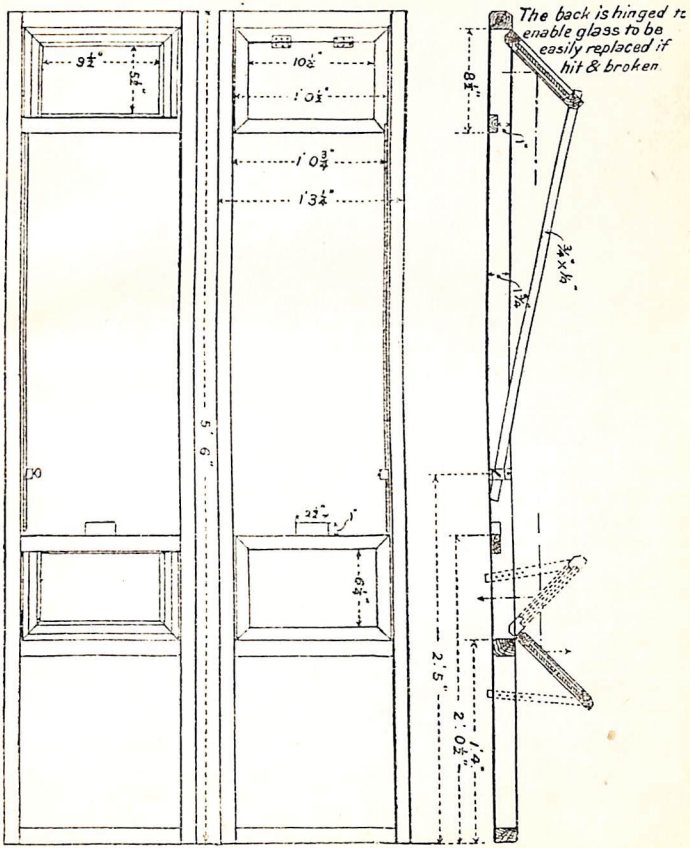
184. Canvas dummies stuffed with straw should be provided for tests of oblique or enfilade fire.

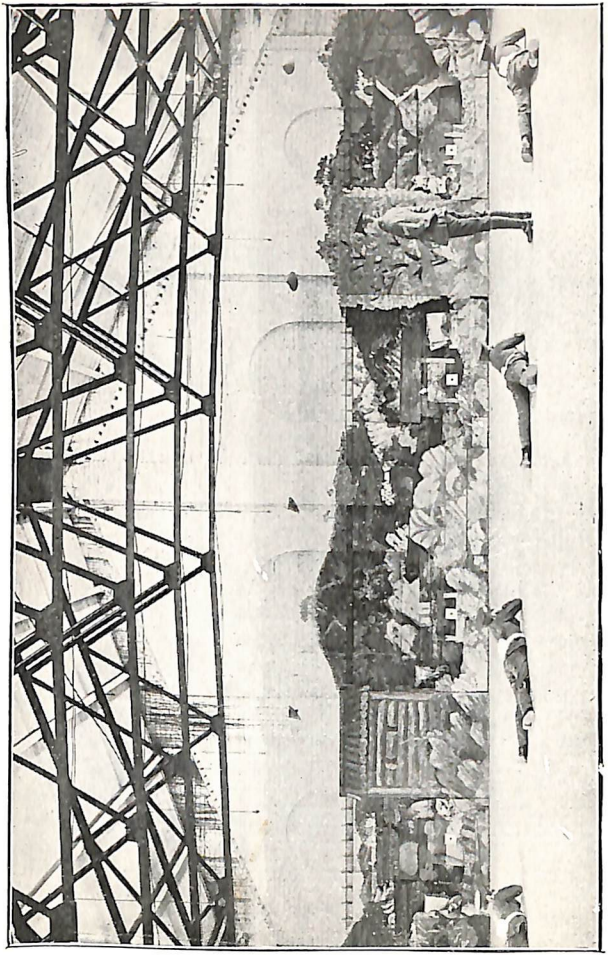
Mirrors may be arranged to represent the flash of field guns.

Special targets should also be constructed of wood to represent accurately field guns, machine guns, mounted figures, &c.

In paras. 198 and 199 is a list of targets and appliances which on demand should be provided on ranges used for field practices for trained soldiers.

Double Reflecting Mirror.





MINIATURE CARTRIDGE RANGE,
R.E. DEPÔT, CHATHAM.

IX.—Mirrors.

185. Plate 50 shews a pattern of double reflecting mirror for use on field practice ranges, or on classification ranges where there are no telephones. This apparatus is fixed with its top glass facing the firing point and just clear of the roof of the shelter. The glasses are adjustable so that the marker can by looking in the lower glass, see what is taking place on the range reflected in the upper glass.

X.—Targets for Miniature Cartridge Ranges.

186. The object of miniature rifle shooting is training for war. It is in no sense a final training but it is a useful and economical preparation for service shooting, especially useful where range accommodation is distant or altogether lacking.

187. The following branches of musketry training can be dealt with to considerable advantage on a miniature cartridge range if suitable targets are provided :—

1. Discernment of service targets.
2. Choice of targets for individual fire.
3. Rapid and accurate adjustment of sights.
4. Accuracy and rapidity of aim.
5. Trigger pressure.
6. Firing in four positions.
7. Adaptation of firing positions to all forms of cover.
8. Aiming off for wind.
9. Training of eyesight.
10. Regulation, direction and control of fire.
11. Principle of mutual assistance in firing.
12. Description and recognition of difficult targets.
13. Use of field glasses.
14. Night firing.

188. As on the open range, elementary instruction may at first be given by means of bullseye targets reduced to the correct scale, *e.g.*, the target for a 25 yards range representing the 2nd Class

elementary target at 200 yards on an open range, would be 25/200 = 1/8th full size, *i.e.*, 6 inches square. The figure targets should similarly be reduced to scale in the correct colours.

These targets can be purchased correctly coloured and scaled for various ranges from several firms.

189. The long range sighting target, the snap shooting and falling targets, the crossing target, the landscape target and the skirmishing target as described for the 30 yards range, may all be adapted for the miniature cartridge range.

190. For indoor ranges a landscape background can be arranged with advantage, and this may be supplemented by a canvas or wooden foreground, also painted. Plate 51 gives an illustration of a miniature range of this type, which is in use at the Royal Engineer Depôt, Chatham. It will be noticed that the two markers' shelters (from which also the moving targets are worked) are designed so as to represent a blockhouse and a wood respectively.

191. It will be found desirable to have that portion of the landscape which is immediately in rear of the bullseye targets prepared on 3 inch planking, and so arranged as to be easily replaced and repainted when shot away; or the sand slope, as described in the previous chapters, may be utilised.

192. If preferred, a bank of clay or sand extending from side to side of the range, and about 4 or 5 feet high may be substituted for the painted landscape.

This will rarely be possible, however, in indoor ranges, unless on the ground floor, owing to the weight and dampness of the clay. This earth bank may be arranged to represent a landscape. Portions can be wooded and roads, entrenchments, building and even streams imitated.

This type of background is easily repairable, and can be altered so as to give variety.

193. Cardboard coloured models of infantry, cavalry, and all arms, designed to scale, can, with a little ingenuity, be used as either stationary or moving targets on such backgrounds.

194. The chief obstacle to the use of such targets will be found in making satisfactory lighting arrangements for night work. The range, of which the illustration is given, is lighted electrically. Figure targets, coloured as in life, seen against a natural background, though easily distinguished in daylight, will be found very hard to see at night, unless brilliantly illuminated by "foot-lights" and side-lights.

In the construction of all such backgrounds, no iron work or stones should be used in places where it would be possible for bullet splashes to injure the markers.

195. For rifle clubs, for voluntary practice, and competitions, the use of such targets will be found to give additional interest, and, provded the model figures are carefully constructed to scale, a considerable amount of training to the firer.

196. Care must be taken that moving targets are made to move at the apparent rate of movement for the range at which the fire is supposed to be delivered.

Thus (*a*) a 6-foot man marching across the range at an assumed distance of 500 yards, will (*see* paragraph 69), be represented by a model 3·6 inches high on a 25 yards range.

A man marching moves at the rate of 100 yards a minute. The model must therefore move at—

$$\frac{100 \times 25}{500} \text{ yards per minute} = 5 \text{ yards per minute.}$$

(*b*) A mounted man 8 feet high, at an assumed distance of 200 yards, is represented by a model 1 foot high on a 25 yards range. If galloping at 15 miles per hour across the range he moves at the rate of 440 yards per minute. The model must therefore move at—

$$\frac{440 \times 25}{200} = 55 \text{ yards per minute;}$$

or approximately, 1 yard per second.

197. In teaching the correct deflection allowances to be made by aiming off for various rates of movement of crossing targets at various distances, the windgauge may be used under the orders

of the instructor to make corrections for the reduced allowances actually necessary at 25 yards range, owing to the difference between the time of flight of the bullet at 25 yards and that for the full range.

XI.—Articles of Store.

198. The following stock of targets should be provided for (i) an eight section range, (ii) an individual field practice range :—

(i)	1st Class Elementary targets	20
	2nd „ „ „	24
	1st „ Figure targets	20
	2nd „ „ „	24
	Crossing figures on poles	10
	Kneeling „ „ „	10
(ii)	Disappearing elementary figure targets	12
	„ prone figures	40
	„ kneeling	40
	„ ¾ figures	20
	Alternative disappearing figures	20
	Iron or steel plates with brackets	30
	Collapsible targets	30
	Screens, 10 feet by 3 feet	15
	Full figures	30

199. The following articles, required for musketry purposes, are to be obtained from the A.O.D.

Article.	By whom supplied.	Service.
Firing rest	See Vocabulary of Stores, 1912, Part II, p. 752.	For musketry instruction.
Aiming rest	„ „ 751	„ „
Ball aiming rest	„ „ 752	„ „

Article.	By whom supplied.	Service.
Aim corrector - - -	See Vocabulary of Stores, 1912, Part II, p. 692.	For musketry instruction.
Canvas, packing, Hessian, 72-inch and 48-inch.	See Vocabulary of Stores, 1912, Part I, p. 341.	For classification ranges.
Nails, clout, ¾-inch - -	Ditto, p. 241 - - -	„ „
Telephones, sets, portable C, complete with cells.	Ditto, Part II, p. 640, 641 -	For classification and Fd. practice ranges.
Bells, electric magneto R.	Ditto, Part II, p. 615 -	For field practice ranges.
Boxes, plug, single - -	Ditto, Part II, p. 616 -	„ „
Boxes, cable, rifle range -	Will shortly be announced in List of Changes in War Matériel.	„ „
Brackets, bell or telephone		
Cases, bell, bracket - -	See Vocabulary of Stores, Part II, p. 600.	
Generators, magneto A. -	Ditto, Part II, p. 622 -	„ „
Twine, packing, large -	Ditto, Part I, p. 192 - -	„ „
„ „ middling	Ditto, „ „ - -	„ „
Cable, electric, "C.I." -	Ditto, Part II, p. 598 -	„ „
Plugs, jack, W.D. - -	See Vocabulary of Stores, 1912, Part II, p. 630.	„ „

200. Other articles authorized for musketry instruction, not enumerated above, are specified in the Schedules of Barrack Furniture and the Equipment Regulations.

201. The following articles are range requisites and are provided by the R.E. for Regular Forces, and by County Associations for the Territorial Force :—

Article.	By whom supplied.	Service.
Paper articles and cardboard targets - -	For further particulars refer to C.R.E.	For classification, 30 yards and miniature ranges.
Veneer targets - - -		For field practice, classification and 30 yards ranges.
Landscape targets - -		For 30 yards and miniature ranges.
Target frames (Hythe pattern) - - - - -		For classification ranges.
Groupings Rings - -		" "
Falling Steel plates $\frac{3}{8}$" thick, weight 18lbs. -		For field practice ranges.
Falling Steel plates $\frac{1}{4}$" thick, weight 2lbs. -		" "
Tiles, 12" by 12" by 1" and covered figure 12" by 12" by 1" - - - -		" "

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